

Supporting Information

Asymmetric Imino-Acylation of Alkenes Enabled by HAT-Photo/Nickel Cocatalysis

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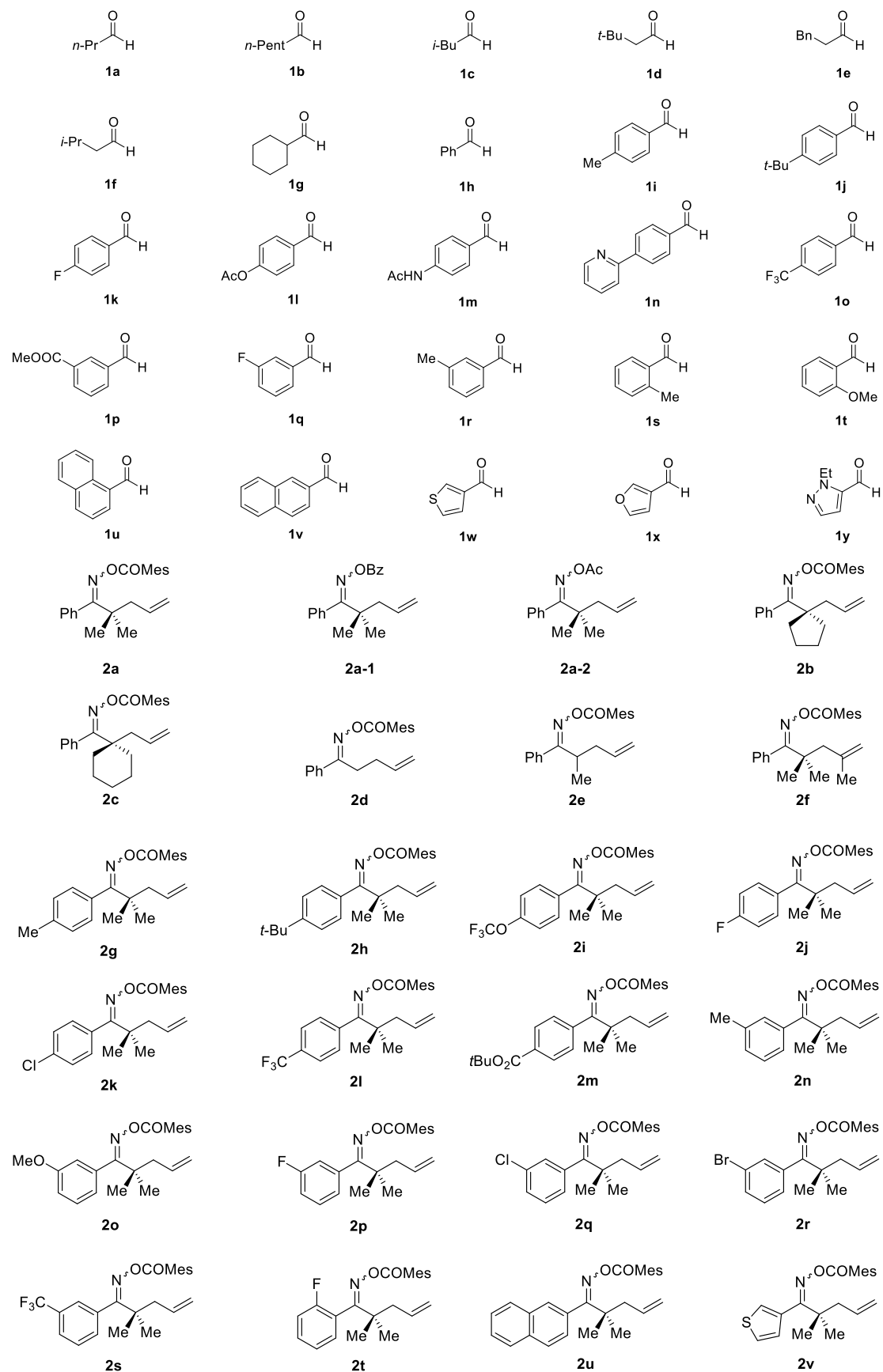
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General information

^1H , ^{13}C , and ^{19}F spectra were recorded in CDCl_3 solution on Bruker Aescend 400 MHz and 500 MHz instruments. ^{19}F NMR were reported as ^{19}F exp. comp. pulse decoupling (^{19}F CPD). The chemical shifts are given in ppm relative to the resonance of the solvent [^1H : δ (CDCl_3) = 7.26, ^{13}C : δ (CDCl_3) = 77.16 ppm] or relative to tetramethylsilane [^1H : δ (SiMe_4) = 0.00 ppm] as an internal standard. Multiplicities are given as: s (singlet); d (doublet); t (triplet); q (quartet); dd (doublet of doublets); m (multiplets), etc. Coupling constants are reported as J values in Hz. High resolution mass spectral analysis (HRMS) was performed on Waters XEVO G2 Q-TOF. HPLC analysis was performed on Thermo UltiMate 3000. Enantiomer excesses were determined by HPLC analysis employing Daicel chiral column (chiralpak IA, chiralpak AD-H) or Guangzhou FLM Scientific Instrument chiral column (chiral MD) with *n*-hexane/*i*-PrOH as the eluents. Flash chromatography was performed using 300-400 mesh silica gel with the indicated solvent system. All air- or moisture-sensitive reactions were protected with nitrogen atmosphere. All reactions were monitored through thin layer chromatography [Merck 60 F254 precoated silica gel plate (0.2 mm thickness)]. Subsequent to elution, spots were visualized using UV radiation (254 nm) on Spectroline Model ZF-7 254 nm. Other visualization methods include staining with a basic solution of potassium permanganate or acidic solution of ceric ammonium molybdate, followed by heating.

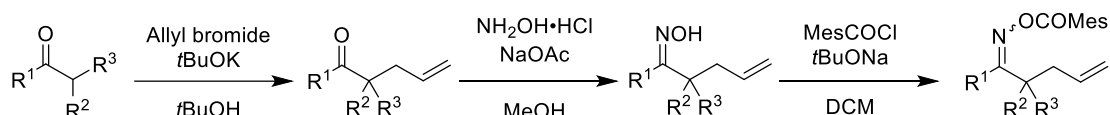
Unless otherwise noted, all reagents and starting materials were purchased from commercial vendors and used as received without further purification. TBADT (tetrabutyl ammonium decatungstate) were synthesized according to the reported method^[1].

Synthesis of Starting Materials

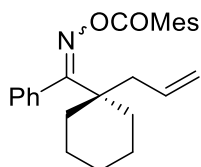


All the aldehydes **1a–1y** used are commercially available. The oxime esters **2a**^[2], **2a-1**^[3], **2a-2**^[4], **2b**^[2], **2d**^[2], **2f–2h**^[2], **2l**^[2], and **2u**^[2] are known compounds in the literature, and their NMR data are consistent to the reported ones. The oxime esters **2c**, **2e**, **2i–2k**, **2m–2t**, and **2v** were prepared according to the procedure reported in the literature.^[2]

General procedure:



(1-Allylcyclohexyl)(phenyl)methanone *O*-(2,4,6-trimethylbenzoyl) oxime (**2c**)



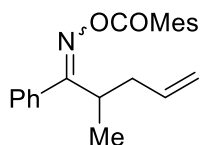
The title compound was isolated as a colorless oil (0.51 g, 1.3 mmol, 13% yield over three steps on 10 mmol scale).

¹H NMR (500 MHz, Chloroform-*d*) δ = 7.38 – 7.30 (m, 3H), 7.14 (d, J = 7.9 Hz, 2H), 6.73 (s, 2H), 6.04 – 5.94 (m, 1H), 5.21 – 5.12 (m, 2H), 2.38 (d, J = 7.2 Hz, 2H), 2.21 (s, 3H), 2.09 (s, 6H), 1.98 – 1.89 (m, 2H), 1.71 – 1.62 (m, 2H), 1.61 – 1.42 (m, 6H). ppm.

¹³C NMR (126 MHz, Chloroform-*d*) δ = 173.1, 167.7, 139.3, 135.8 (2C), 133.9, 133.1, 129.4, 128.34, 128.26 (2C), 128.0 (2C), 126.9 (2C), 118.0, 45.2, 41.1, 33.6 (2C), 26.0, 22.2 (2C), 21.1, 19.8 (2C) ppm.

HRMS (ESI) m/z calculated for C₂₆H₃₁NO₂H⁺ [M+H]⁺: 390.2428, found: 390.2428.

2-Methyl-1-phenylpent-4-en-1-one *O*-(2,4,6-trimethylbenzoyl) oxime (**2e**)



The title compound was isolated as a yellow oil (0.47 g, 1.4 mmol, 28% yield over three

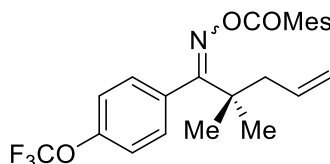
steps on 5 mmol scale).

¹H NMR (500 MHz, Chloroform-*d*) δ = 7.53 (d, J = 6.3 Hz, 2H), 7.45 – 7.37 (m, 3H), 6.90 (s, 2H), 5.74 – 5.64 (m, 1H), 5.03 – 4.95 (m, 2H), 3.54 – 3.45 (m, 1H), 2.44 – 2.39 (m, 1H), 2.38 (s, 6H), 2.32 (s, 3H), 2.22 – 2.16 (m, 1H), 1.25 (d, J = 7.1 Hz, 3H) ppm.

¹³C NMR (126 MHz, Chloroform-*d*) δ = 171.7, 167.6, 139.9, 135.70 (2C), 135.66, 134.3, 129.8, 129.7, 128.5 (2C), 128.4 (4C), 117.2, 38.1, 35.6, 21.4, 19.9 (2C), 17.7 ppm.

HRMS (ESI) m/z calculated for C₂₂H₂₅NO₂Na⁺ [M+Na]⁺: 358.1778, found: 358.1777.

2,2-Dimethyl-1-(4-(trifluoromethoxy)phenyl)pent-4-en-1-one O-(2,4,6-trimethylbenzoyl) oxime (2i)



The title compound was isolated as a yellow oil (1.43 g, 3.3 mmol, 33% yield over three steps on 10 mmol scale).

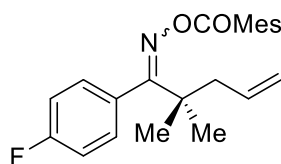
¹H NMR (400 MHz, Chloroform-*d*) δ = 7.23 (d, J = 8.3 Hz, 2H), 7.15 (d, J = 8.8 Hz, 2H), 6.75 (s, 2H), 6.02 – 5.86 (m, 1H), 5.22 – 5.07 (m, 2H), 2.37 (d, J = 6.9 Hz, 2H), 2.22 (s, 3H), 2.07 (s, 6H), 1.26 (s, 6H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 173.7, 167.3, 149.2 (q, J = 1.8 Hz), 139.7, 135.9 (2C), 134.1, 132.0, 129.0, 128.7 (2C), 128.4 (2C), 120.6 (2C), 120.5 (q, J = 257.7 Hz), 118.5, 44.2, 41.7, 25.7 (2C), 21.1, 19.8 (2C) ppm.

¹⁹F NMR (376 MHz, Chloroform-*d*) δ = –57.81 (s, 3F) ppm.

HRMS (ESI) m/z calculated for C₂₄H₂₆F₃NO₃Na⁺ [M+Na]⁺: 456.1757, found: 456.1757.

1-(4-Fluorophenyl)-2,2-dimethylpent-4-en-1-one ***O*-(2,4,6-trimethylbenzoyl)**
oxime (2j)



The title compound was isolated as a white solid (1.47 g, 4.0 mmol, 40% yield over three steps on 10 mmol scale).

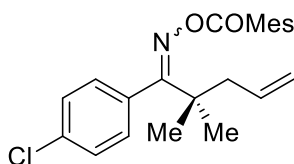
¹H NMR (500 MHz, Chloroform-*d*) δ = 7.10 – 7.03 (m, 4H), 6.74 (s, 2H), 5.99 – 5.89 (m, 1H), 5.18 – 5.09 (m, 2H), 2.36 (d, J = 7.3 Hz, 2H), 2.20 (s, 3H), 2.11 (s, 6H), 1.25 (s, 6H) ppm.

¹³C NMR (126 MHz, Chloroform-*d*) δ = 173.7, 167.3, 162.5 (d, J = 248.1 Hz), 139.5, 135.8 (2C), 134.1, 129.1 (d, J = 3.7 Hz), 129.0, 128.8 (d, J = 8.0 Hz, 2C), 128.3 (2C), 118.3, 115.2 (d, J = 21.7 Hz, 2C), 44.2, 41.6, 25.7 (2C), 21.0, 19.8 (2C) ppm.

¹⁹F NMR (471 MHz, Chloroform-*d*) δ = –112.67 (s, 1F) ppm.

HRMS (ESI) m/z calculated for C₂₃H₂₆FNO₂Na⁺ [M+Na]⁺: 390.1841, found: 390.1840.

1-(4-Chlorophenyl)-2,2-dimethylpent-4-en-1-one ***O*-(2,4,6-trimethylbenzoyl)**
oxime (2k)



The title compound was isolated as a yellow oil (1.49 g, 3.9 mmol, 39% yield over three steps on 10 mmol scale).

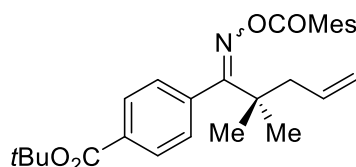
¹H NMR (400 MHz, Chloroform-*d*) δ = 7.34 (d, J = 8.4 Hz, 2H), 7.03 (d, J = 8.4 Hz, 2H), 6.75 (s, 2H), 6.00 – 5.86 (m, 1H), 5.20 – 5.07 (m, 2H), 2.35 (d, J = 7.2 Hz, 2H), 2.21 (s, 3H), 2.11 (s, 6H), 1.25 (s, 6H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 173.5, 167.3, 139.6, 135.9 (2C), 134.5, 134.1, 131.6, 129.0, 128.39 (2C), 128.36 (2C), 128.33 (2C), 118.5, 44.2, 41.6, 25.7 (2C), 21.1,

19.9 (2C) ppm.

HRMS (ESI) m/z calculated for $C_{23}H_{26}ClNO_2Na^+$ $[M+Na]^+$: 406.1544, found: 406.1550.

***tert*-Butyl 4-(2,2-dimethyl-1-(((2,4,6-trimethylbenzoyl)oxy)imino)pent-4-en-1-yl)-benzoate (2m)**



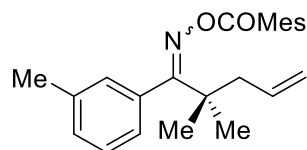
The title compound was isolated as a white solid (0.99 g, 2.2 mmol, 22% yield over three steps on 10 mmol scale).

1H NMR (500 MHz, Chloroform-*d*) δ = 7.97 (d, J = 8.2 Hz, 2H), 7.14 (d, J = 8.3 Hz, 2H), 6.66 (s, 2H), 5.95 – 5.86 (m, 1H), 5.15 – 5.04 (m, 2H), 2.33 (d, J = 7.3 Hz, 2H), 2.12 (s, 3H), 2.08 (s, 6H), 1.55 (s, 9H), 1.21 (s, 6H) ppm.

^{13}C NMR (126 MHz, Chloroform-*d*) δ = 173.4, 167.0, 164.8, 139.3, 137.3, 135.6 (2C), 133.8, 131.8, 128.9 (2C), 128.8, 128.2 (2C), 126.7 (2C), 118.3, 81.1, 44.1, 41.3, 28.0 (3C), 25.5 (2C), 20.9, 19.7 (2C) ppm.

HRMS (ESI) m/z calculated for $C_{28}H_{35}NO_4H^+$ $[M+H]^+$: 450.2639, found: 450.2643.

2,2-Dimethyl-1-(*m*-tolyl)pent-4-en-1-one *O*-(2,4,6-trimethylbenzoyl) oxime (2n)



The title compound was isolated as a yellow oil (1.56 g, 4.3 mmol, 43% yield over three steps on 10 mmol scale).

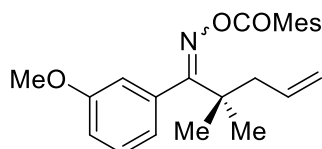
1H NMR (500 MHz, Chloroform-*d*) δ = 7.23 (t, J = 8.0 Hz, 1H), 7.13 (d, J = 7.8 Hz, 1H), 6.92 – 6.86 (m, 2H), 6.73 (s, 2H), 6.02 – 5.90 (m, 1H), 5.19 – 5.07 (m, 2H), 2.38 (d, J = 7.3 Hz, 2H), 2.34 (s, 3H), 2.21 (s, 3H), 2.10 (s, 6H), 1.26 (s, 6H) ppm.

^{13}C NMR (126 MHz, Chloroform-*d*) δ = 175.0, 167.6, 139.4, 137.6, 135.9 (2C), 134.4, 133.3, 129.4, 129.0, 128.3 (2C), 127.9, 127.4, 124.0, 118.2, 44.3, 41.6, 25.8 (2C), 21.5,

21.1, 19.8 (2C) ppm.

HRMS (ESI) m/z calculated for $C_{24}H_{29}NO_2H^+$ $[M+H]^+$: 364.2271, found: 364.2278.

1-(3-Methoxyphenyl)-2,2-dimethylpent-4-en-1-one O-(2,4,6-trimethylbenzoyl) oxime (2o)



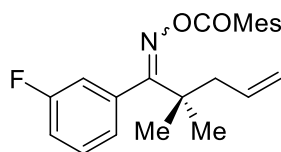
The title compound was isolated as a yellow solid (2.16 g, 5.7 mmol, 57% yield over three steps on 10 mmol scale).

1H NMR (400 MHz, Chloroform-*d*) δ = 7.23 (t, J = 7.9 Hz, 1H), 6.81 (d, J = 8.3 Hz, 1H), 6.69 (s, 2H), 6.64 (d, J = 7.6 Hz, 1H), 6.60 (s, 1H), 5.99 – 5.86 (m, 1H), 5.16 – 5.05 (m, 2H), 3.71 (s, 3H), 2.37 (d, J = 7.2 Hz, 2H), 2.16 (s, 3H), 2.09 (s, 6H), 1.24 (s, 6H) ppm.

^{13}C NMR (101 MHz, Chloroform-*d*) δ = 174.4, 167.5, 159.1, 139.4, 135.8 (2C), 134.4, 134.3, 129.2, 129.1, 128.2 (2C), 119.2, 118.2, 113.4, 112.9, 55.1, 44.3, 41.5, 25.8 (2C), 21.0, 19.8 (2C) ppm.

HRMS (ESI) m/z calculated for $C_{24}H_{29}NO_3Na^+$ $[M+Na]^+$: 402.2040, found: 402.2046.

1-(3-Fluorophenyl)-2,2-dimethylpent-4-en-1-one O-(2,4,6-trimethylbenzoyl) oxime (2p)



The title compound was isolated as a yellow oil (1.25 g, 3.4 mmol, 34% yield over three steps on 10 mmol scale).

1H NMR (400 MHz, Chloroform-*d*) δ = 7.37 – 7.29 (m, 1H), 7.03 (t, J = 8.6 Hz, 1H), 6.87 (d, J = 7.6 Hz, 1H), 6.83 (d, J = 8.7 Hz, 1H), 6.74 (s, 2H), 6.00 – 5.87 (m, 1H), 5.20 – 5.09 (m, 2H), 2.38 (d, J = 7.2 Hz, 2H), 2.21 (s, 3H), 2.12 (s, 6H), 1.26 (s, 6H) ppm.

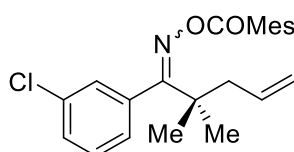
^{13}C NMR (101 MHz, Chloroform-*d*) δ = 173.2 (d, J = 1.5 Hz), 167.4, 162.2 (d, J =

247.5 Hz), 139.6, 135.9 (2C), 135.2 (d, $J = 7.6$ Hz), 134.1, 129.8 (d, $J = 8.2$ Hz), 129.0, 128.4 (2C), 122.7 (d, $J = 3.3$ Hz), 118.5, 115.4 (d, $J = 20.9$ Hz), 114.3 (d, $J = 22.8$ Hz), 44.2, 41.6, 25.7 (2C), 21.1, 19.8 (2C) ppm.

^{19}F NMR (376 MHz, Chloroform-*d*) $\delta = -112.26$ (s, 1F) ppm.

HRMS (ESI) m/z calculated for $\text{C}_{23}\text{H}_{26}\text{OFNO}_2\text{H}^+$ $[\text{M}+\text{H}]^+$: 368.2020, found: 368.2027.

1-(3-Chlorophenyl)-2,2-dimethylpent-4-en-1-one ***O*-(2,4,6-trimethylbenzoyl)**
oxime (2q)



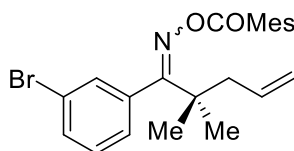
The title compound was isolated as a yellow solid (1.45 g, 2.5 mmol, 25% yield over three steps on 10 mmol scale).

^1H NMR (400 MHz, Chloroform-*d*) $\delta = 7.32 - 7.23$ (m, 2H), 7.08 (s, 1H), 6.99 – 6.93 (m, 1H), 6.73 (s, 2H), 5.98 – 5.86 (m, 1H), 5.18 – 5.07 (m, 2H), 2.35 (d, $J = 7.1$ Hz, 2H), 2.19 (s, 3H), 2.10 (s, 6H), 1.24 (s, 6H) ppm.

^{13}C NMR (101 MHz, Chloroform-*d*) $\delta = 173.1, 167.3, 139.6, 135.9$ (2C), 135.0, 134.2, 134.0, 129.5, 129.0, 128.6, 128.4 (2C), 126.9, 125.1, 118.6, 44.2, 41.6, 25.7 (2C), 21.1, 19.8 (2C) ppm.

HRMS (ESI) m/z calculated for $\text{C}_{23}\text{H}_{26}\text{ClNO}_2\text{Na}^+$ $[\text{M}+\text{Na}]^+$: 406.1544, found: 406.1549.

1-(3-Bromophenyl)-2,2-dimethylpent-4-en-1-one ***O*-(2,4,6-trimethylbenzoyl)**
oxime (2r)



The title compound was isolated as a white solid (2.26 g, 5.3 mmol, 53% yield over three steps on 10 mmol scale).

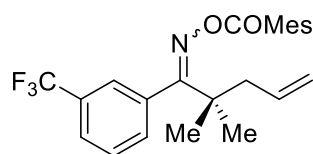
^1H NMR (400 MHz, Chloroform-*d*) $\delta = 7.44$ (d, $J = 8.5$ Hz, 1H), 7.25 – 7.18 (m, 2H), 7.01 (d, $J = 7.7$ Hz, 1H), 6.73 (s, 2H), 5.98 – 5.84 (m, 1H), 5.18 – 5.06 (m, 2H), 2.35

(d, $J = 7.2$ Hz, 2H), 2.20 (s, 3H), 2.11 (s, 6H), 1.24 (s, 6H) ppm.

^{13}C NMR (101 MHz, Chloroform-*d*) $\delta = 173.0, 167.3, 139.6, 135.9$ (2C), 135.2, 134.0, 131.5, 129.7 (2C), 129.0, 128.4 (2C), 125.6, 122.2, 118.6, 44.2, 41.6, 25.7 (2C), 21.1, 19.9 (2C) ppm.

HRMS (ESI) m/z calculated for $\text{C}_{23}\text{H}_{26}\text{BrNO}_2\text{Na}^+$ $[\text{M}+\text{Na}]^+$: 450.1039, found: 450.1041.

2,2-Dimethyl-1-(3-(trifluoromethyl)phenyl)pent-4-en-1-one *O*-(2,4,6-trimethylbenzoyl) oxime (2s)



The title compound was isolated as a yellow solid (1.71 g, 4.1 mmol, 41% yield over three steps on 10 mmol scale).

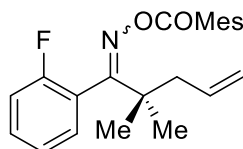
^1H NMR (500 MHz, Chloroform-*d*) $\delta = 7.60$ (d, $J = 7.9$ Hz, 1H), 7.49 (t, $J = 7.8$ Hz, 1H), 7.37 (s, 1H), 7.28 (d, $J = 7.8$ Hz, 1H), 6.74 (s, 2H), 5.99 – 5.89 (m, 1H), 5.20 – 5.09 (m, 2H), 2.37 (d, $J = 7.2$ Hz, 2H), 2.21 (s, 3H), 2.08 (s, 6H), 1.27 (s, 6H) ppm.

^{13}C NMR (126 MHz, Chloroform-*d*) $\delta = 173.0, 167.3, 139.8, 136.0$ (2C), 134.1, 134.0, 130.6 (q, $J = 33.0$ Hz), 130.5, 128.9, 128.8, 128.4 (2C), 125.3 (q, $J = 3.7$ Hz), 123.8 (q, $J = 272.5$ Hz), 123.8 (q, $J = 3.8$ Hz), 118.7, 44.3, 41.7, 25.7 (2C), 21.2, 19.8 (2C) ppm.

^{19}F NMR (471 MHz, Chloroform-*d*) $\delta = -62.73$ (s, 3F) ppm.

HRMS (ESI) m/z calculated for $\text{C}_{24}\text{H}_{26}\text{F}_3\text{NO}_2\text{H}^+$ $[\text{M}+\text{H}]^+$: 418.1988, found: 418.1989.

1-(2-Fluorophenyl)-2,2-dimethylpent-4-en-1-one *O*-(2,4,6-trimethylbenzoyl) oxime (2t)



The title compound was isolated as a yellow oil (0.99 g, 2.7 mmol, 27% yield over three steps on 10 mmol scale).

^1H NMR (400 MHz, Chloroform-*d*) $\delta = 7.36 - 7.27$ (m, 1H), 7.14 (t, $J = 7.4$ Hz, 1H),

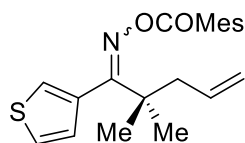
7.11 – 7.01 (m, 2H), 6.73 (s, 2H), 6.02 – 5.88 (m, 1H), 5.19 – 5.07 (m, 2H), 2.43 (d, $J = 7.2$ Hz, 2H), 2.20 (s, 3H), 2.13 (s, 6H), 1.29 (s, 3H), 1.23 (s, 3H) ppm.

^{13}C NMR (101 MHz, Chloroform-*d*) $\delta = 169.2$ (d, $J = 1.7$ Hz), 167.3, 158.0 (d, $J = 246.9$ Hz), 139.5, 135.9 (2C), 134.2, 130.5 (d, $J = 7.9$ Hz), 129.1, 128.3 (2C), 128.2, 123.7 (d, $J = 3.4$ Hz), 121.1 (d, $J = 18.7$ Hz), 118.3, 115.7 (d, $J = 21.5$ Hz), 44.2, 41.8, 25.5, 25.1, 21.1, 19.7 (2C) ppm.

^{19}F NMR (376 MHz, Chloroform-*d*) $\delta = -111.75$ (s, 1F) ppm.

HRMS (ESI) m/z calculated for $\text{C}_{23}\text{H}_{26}\text{FNO}_2\text{H}^+$ $[\text{M}+\text{H}]^+$: 368.2020, found: 368.2019.

2,2-Dimethyl-1-(thiophen-3-yl)pent-4-en-1-one *O*-(2,4,6-trimethylbenzoyl) oxime (2v)



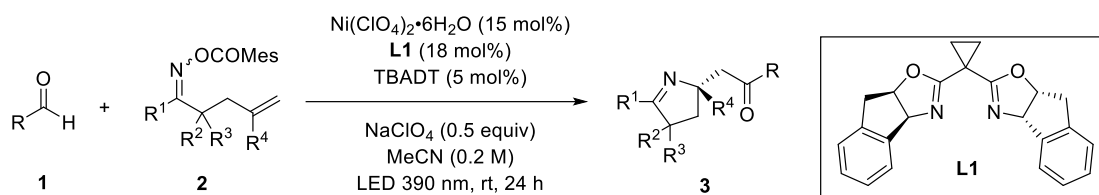
The title compound was isolated as a white solid (2.26 g, 6.4 mmol, 64% yield over three steps on 10 mmol scale).

^1H NMR (400 MHz, Chloroform-*d*) $\delta = 7.32 - 7.28$ (m, 1H), 7.13 – 7.08 (m, 1H), 6.90 (d, $J = 5.0$ Hz, 1H), 6.76 (s, 2H), 5.96 – 5.84 (m, 1H), 5.17 – 5.05 (m, 2H), 2.33 (d, $J = 7.2$ Hz, 2H), 2.23 (s, 3H), 2.12 (s, 6H), 1.27 (s, 6H) ppm.

^{13}C NMR (101 MHz, Chloroform-*d*) $\delta = 171.3$, 167.6, 139.6, 136.0 (2C), 134.3, 132.2, 129.2, 128.4 (2C), 127.4, 125.3, 122.9, 118.3, 44.4, 41.8, 25.7 (2C), 21.2, 19.8 (2C) ppm.

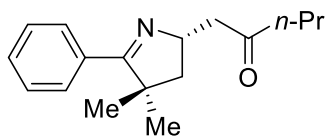
HRMS (ESI) m/z calculated for $\text{C}_{21}\text{H}_{25}\text{NO}_2\text{SNa}^+$ $[\text{M}+\text{Na}]^+$: 378.1498, found: 378.1498.

General Procedure for Ni/Photo-Cocatalyzed Asymmetric Iminoacylation of Alkenes



Tetrabutyl ammonium decatungstate (TBADT) (33.2 mg, 0.01 mmol, 5 mol%), $\text{Ni}(\text{ClO}_4)_2 \cdot 6\text{H}_2\text{O}$ (11.0 mg, 0.03 mmol, 15 mol%), ligand **L1** (12.8 mg, 0.036 mmol, 18 mol%), NaClO_4 (12.2 mg, 0.1 mmol, 0.5 equiv), aldehydes **1** if solid (0.6 mmol, 3 equiv) and the oxime esters **2** (0.2 mmol, 1 equiv) were placed in an oven-dried test tube equipped with a magnetic stirring bar. The tube was evacuated and filled with nitrogen (three cycles). To these solids, anhydrous MeCN (1 mL, 0.2 M) and aldehydes **1** if liquid (0.6 mmol, 3 equiv) were added sequentially under nitrogen atmosphere. Subsequently, the reaction mixture was stirred and irradiated using two 34 W 390 nm LED lamps (Kessil PR160-390, 5 cm away, with adequate fans keep the reaction at room temperature) for 24 h. After exposing to air for 15 minutes, the reaction mixture was filtered through a pad of Celite and concentrated under reduced pressure. The residue was purified through column chromatography (silica gel, EtOAc/petroleum ether) to afford the desired products **3**.

(*S*)-1-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)pentan-2-one (**3aa**)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (34.0 mg, 66% yield).

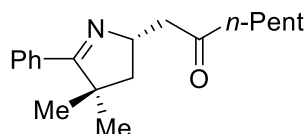
$^1\text{H NMR}$ (500 MHz, Chloroform-*d*) δ = 7.66 (d, J = 8.0 Hz, 2H), 7.41 – 7.32 (m, 3H), 4.45 – 4.36 (m, 1H), 3.10 (dd, J = 16.4, 5.4 Hz, 1H), 2.54 (dd, J = 16.4, 8.6 Hz, 1H), 2.51 – 2.41 (m, 2H), 2.23 (dd, J = 12.6, 6.7 Hz, 1H), 1.69 – 1.58 (m, 2H), 1.49 (dd, J = 12.6, 8.8 Hz, 1H), 1.35 (s, 3H), 1.33 (s, 3H), 0.93 (t, J = 7.4 Hz, 3H) ppm.

^{13}C NMR (126 MHz, Chloroform-*d*) δ = 210.1, 180.1, 134.7, 129.6, 128.3 (2C), 128.0 (2C), 64.1, 50.8, 49.8, 48.6, 45.6, 27.4, 25.9, 17.3, 13.9 ppm.

HRMS (ESI) m/z calculated for $\text{C}_{17}\text{H}_{23}\text{NOH}^+$ $[\text{M}+\text{H}]^+$: 258.1582, found: 258.1857.

HPLC-Data: 99% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): t_{R} = 10.1 (minor), 10.8 (major).

(*S*)-1-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)heptan-2-one (3ba)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (38.8 mg, 68% yield).

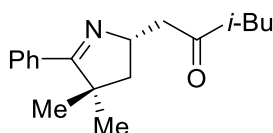
^1H NMR (500 MHz, Chloroform-*d*) δ = 7.67 (d, J = 8.1 Hz, 2H), 7.42 – 7.33 (m, 3H), 4.44 – 4.36 (m, 1H), 3.11 (dd, J = 16.3, 5.4 Hz, 1H), 2.55 (dd, J = 16.4, 8.7 Hz, 1H), 2.52 – 2.42 (m, 2H), 2.23 (dd, J = 12.5, 6.7 Hz, 1H), 1.66 – 1.57 (m, 2H), 1.50 (dd, J = 12.6, 8.8 Hz, 1H), 1.35 (s, 3H), 1.33 (s, 3H), 1.32 – 1.24 (m, 4H), 0.89 (t, J = 6.9 Hz, 3H) ppm.

^{13}C NMR (126 MHz, Chloroform-*d*) δ = 210.2, 180.1, 134.8, 129.6, 128.3 (2C), 128.0 (2C), 64.2, 50.8, 49.8, 48.6, 43.7, 31.5, 27.4, 26.0, 23.6, 22.6, 14.1 ppm.

HRMS (ESI) m/z calculated for $\text{C}_{19}\text{H}_{27}\text{NOH}^+$ $[\text{M}+\text{H}]^+$: 286.2165, found: 286.2166.

HPLC-Data: 97% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): t_{R} = 12.9 (minor), 14.3 (major).

(*S*)-1-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-4-methylpentan-2-one (3ca)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (33.6 mg, 62% yield).

^1H NMR (400 MHz, Chloroform-*d*) δ = 7.66 (d, J = 7.9 Hz, 2H), 7.42 – 7.32 (m, 3H), 4.46 – 4.34 (m, 1H), 3.12 (dd, J = 16.6, 5.2 Hz, 1H), 2.52 (dd, J = 16.5, 8.8 Hz, 1H),

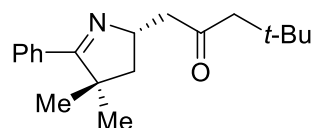
2.42 – 2.32 (m, 2H), 2.24 (dd, $J = 12.6, 6.7$ Hz, 1H), 2.21 – 2.13 (m, 1H), 1.49 (dd, $J = 12.6, 8.8$ Hz, 1H), 1.35 (s, 3H), 1.33 (s, 3H), 0.93 (d, $J = 6.6$ Hz, 6H) ppm.

^{13}C NMR (101 MHz, Chloroform- d) $\delta = 209.8, 180.1, 134.7, 129.6, 128.3$ (2C), 128.0 (2C), 64.0, 52.7, 50.8, 50.3, 48.6, 27.4, 25.9, 24.7, 22.74, 22.70 ppm.

HRMS (ESI) m/z calculated for $\text{C}_{18}\text{H}_{25}\text{NOH}^+$ $[\text{M}+\text{H}]^+$: 272.2009, found: 272.2009.

HPLC-Data: 90% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_{\text{R}} = 12.0$ (minor), 13.8 (major).

(*S*)-1-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-4,4-dimethylpentan-2-one (3da)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 6:1) as a colorless oil (34.8 mg, 61% yield).

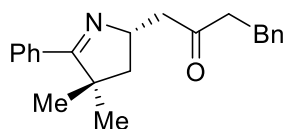
^1H NMR (400 MHz, Chloroform- d) $\delta = 7.66$ (d, $J = 7.9$ Hz, 2H), 7.41 – 7.33 (m, 3H), 4.45 – 4.35 (m, 1H), 3.18 (dd, $J = 16.8, 4.9$ Hz, 1H), 2.53 (dd, $J = 16.8, 9.1$ Hz, 1H), 2.42 – 2.33 (m, 2H), 2.26 (dd, $J = 12.6, 6.7$ Hz, 1H), 1.49 (dd, $J = 12.6, 8.8$ Hz, 1H), 1.35 (s, 3H), 1.33 (s, 3H), 1.04 (s, 9H) ppm.

^{13}C NMR (101 MHz, Chloroform- d) $\delta = 209.7, 180.2, 134.7, 129.7, 128.3$ (2C), 128.0 (2C), 64.0, 55.7, 52.1, 50.8, 48.6, 31.3, 29.9 (3C), 27.4, 25.9 ppm.

HRMS (ESI) m/z calculated for $\text{C}_{19}\text{H}_{27}\text{NOH}^+$ $[\text{M}+\text{H}]^+$: 286.2165, found: 286.2168.

HPLC-Data: 94% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_{\text{R}} = 11.5$ (minor), 12.2 (major).

(*S*)-1-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-4-phenylbutan-2-one (3ea)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (36.4 mg, 57% yield).

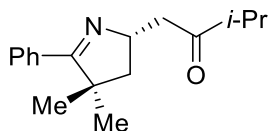
¹H NMR (500 MHz, Chloroform-*d*) δ = 7.67 (d, J = 8.2 Hz, 2H), 7.41 – 7.34 (m, 3H), 7.30 – 7.26 (m, 2H), 7.23 – 7.18 (m, 3H), 4.45 – 4.37 (m, 1H), 3.09 (dd, J = 16.2, 5.7 Hz, 1H), 2.98 – 2.92 (m, 2H), 2.89 – 2.78 (m, 2H), 2.55 (dd, J = 16.2, 8.4 Hz, 1H), 2.20 (dd, J = 12.6, 6.8 Hz, 1H), 1.48 (dd, J = 12.6, 8.8 Hz, 1H), 1.35 (s, 3H), 1.32 (s, 3H) ppm.

¹³C NMR (126 MHz, Chloroform-*d*) δ = 209.0, 180.2, 141.2, 134.6, 129.7, 128.6 (2C), 128.5 (2C), 128.3 (2C), 128.0 (2C), 126.2, 64.1, 50.8, 50.0, 48.5, 45.2, 29.8, 27.4, 25.9 ppm.

HRMS (ESI) m/z calculated for C₂₂H₂₅NOH⁺ [M+H]⁺: 320.2009, found: 320.2010.

HPLC-Data: 95% *ee*, (Chiralpak IA column, λ = 254 nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): t_R = 14.5 (major), 20.5 (minor).

(S)-2-(1-(4-Chlorophenyl)-2-oxopentyl)cyclohex-2-en-1-one (3fa)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (24.2 mg, 47% yield).

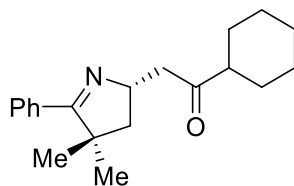
¹H NMR (500 MHz, Chloroform-*d*) δ = 7.67 (d, J = 8.1 Hz, 2H), 7.40 – 7.34 (m, 3H), 4.46 – 4.37 (m, 1H), 3.22 (dd, J = 16.8, 5.0 Hz, 1H), 2.71 – 2.63 (m, 1H), 2.58 (dd, J = 16.8, 9.1 Hz, 1H), 2.26 (dd, J = 12.5, 6.7 Hz, 1H), 1.47 (dd, J = 12.6, 8.8 Hz, 1H), 1.35 (s, 3H), 1.33 (s, 3H), 1.14 (d, J = 6.8 Hz, 3H), 1.12 (d, J = 6.9 Hz, 3H) ppm.

¹³C NMR (126 MHz, Chloroform-*d*) δ = 213.6, 180.1, 134.7, 129.6, 128.3 (2C), 128.0 (2C), 64.2, 50.8, 48.8, 47.4, 41.4, 27.4, 26.0, 18.3, 18.2 ppm.

HRMS (ESI) m/z calculated for C₁₇H₂₃NONa⁺ [M+Na]⁺: 280.1672, found: 280.1676.

HPLC-Data: 98% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): t_R = 10.6 (major), 11.6 (minor).

(S)-1-Cyclohexyl-2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)ethan-1-one (3ga)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (27.3 mg, 46% yield).

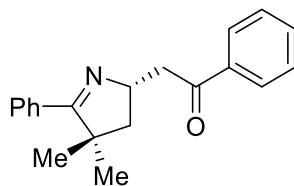
¹H NMR (400 MHz, Chloroform-*d*) δ = 7.67 (d, J = 7.9 Hz, 2H), 7.42 – 7.32 (m, 3H), 4.47 – 4.33 (m, 1H), 3.20 (dd, J = 16.9, 4.9 Hz, 1H), 2.56 (dd, J = 16.9, 9.2 Hz, 1H), 2.45 – 2.35 (m, 1H), 2.25 (dd, J = 12.6, 6.7 Hz, 1H), 1.93 – 1.84 (m, 2H), 1.82 – 1.75 (m, 2H), 1.70 – 1.62 (m, 1H), 1.46 (dd, J = 12.6, 8.8 Hz, 1H), 1.35 (s, 3H), 1.33 (s, 3H), 1.39 – 1.18 (m, 5H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 213.0, 180.0, 134.8, 129.6, 128.3 (2C), 128.0 (2C), 64.2, 51.3, 50.8, 48.8, 47.8, 28.52, 28.46, 27.5, 26.0 (2C), 25.82, 25.77 ppm.

HRMS (ESI) m/z calculated for C₂₀H₂₇NOH⁺ [M+H]⁺: 298.2165, found: 298.2174.

HPLC-Data: 92% *ee*, (Chiralpak IA column, λ = 254 nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): t_R = 10.9 (major), 13.2 (minor).

(S)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-1-phenylethan-1-one (3ha)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (34.3 mg, 59% yield).

¹H NMR (400 MHz, Chloroform-*d*) δ = 8.02 (d, J = 8.6 Hz, 2H), 7.69 (d, J = 7.9 Hz, 2H), 7.58 (t, J = 7.3 Hz, 1H), 7.48 (t, J = 7.7 Hz, 2H), 7.42 – 7.35 (m, 3H), 4.66 – 4.55 (m, 1H), 3.84 (dd, J = 16.8, 4.5 Hz, 1H), 3.06 (dd, J = 16.8, 9.5 Hz, 1H), 2.35 (dd, J = 12.7, 6.8 Hz, 1H), 1.60 (dd, J = 12.7, 8.7 Hz, 1H), 1.38 (s, 3H), 1.36 (s, 3H) ppm.

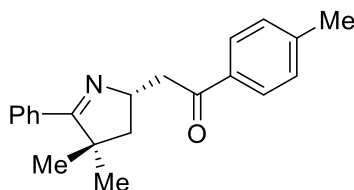
¹³C NMR (101 MHz, Chloroform-*d*) δ = 198.9, 180.3, 137.2, 134.8, 133.3, 129.6, 128.7

(2C), 128.33 (2C), 128.31 (2C), 128.0 (2C), 64.5, 50.9, 48.8, 46.0, 27.5, 26.0 ppm.

HRMS (ESI) m/z calculated for $C_{20}H_{21}NOH^+$ $[M+H]^+$: 292.1696, found: 292.1699.

HPLC-Data: 92% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): t_R = 15.8 (major), 18.0 (minor).

(S)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-1-(p-tolyl)ethan-1-one
(3ia)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (38.3 mg, 63% yield).

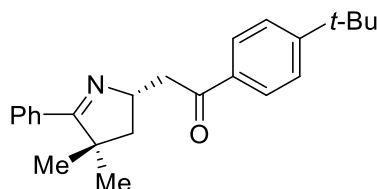
1H NMR (400 MHz, Chloroform-*d*) δ = 7.93 (d, J = 8.2 Hz, 2H), 7.69 (d, J = 7.8 Hz, 2H), 7.41 – 7.35 (m, 3H), 7.28 (d, J = 7.9 Hz, 2H), 4.64 – 4.54 (m, 1H), 3.82 (dd, J = 16.6, 4.4 Hz, 1H), 3.03 (dd, J = 16.7, 9.6 Hz, 1H), 2.42 (s, 3H), 2.34 (dd, J = 12.7, 6.7 Hz, 1H), 1.59 (dd, J = 12.7, 8.7 Hz, 1H), 1.37 (s, 3H), 1.36 (s, 3H) ppm.

^{13}C NMR (101 MHz, Chloroform-*d*) δ = 198.6, 180.2, 144.0, 134.8, 134.7, 129.6, 129.4 (2C), 128.4 (2C), 128.3 (2C), 128.0 (2C), 64.6, 50.9, 48.8, 45.9, 27.5, 26.0, 21.8 ppm.

HRMS (ESI) m/z calculated for $C_{21}H_{23}NOH^+$ $[M+H]^+$: 306.1852, found: 306.1856.

HPLC-Data: 97% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 92/8, flow rate = 0.5 mL/min): t_R = 11.9 (major), 15.5 (minor).

(S)-1-(4-(tert-Butyl)phenyl)-2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)ethan-1-one (3ja)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 6:1) as a colorless oil (49.3 mg, 71% yield).

1H NMR (400 MHz, Chloroform-*d*) δ = 7.97 (d, J = 8.5 Hz, 2H), 7.69 (d, J = 7.9 Hz,

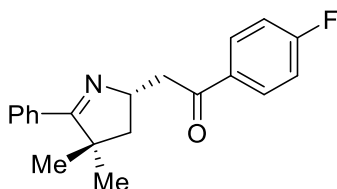
2H), 7.49 (d, $J = 8.5$ Hz, 2H), 7.41 – 7.35 (m, 3H), 4.66 – 4.54 (m, 1H), 3.83 (dd, $J = 16.7, 4.3$ Hz, 1H), 3.04 (dd, $J = 16.7, 9.7$ Hz, 1H), 2.35 (dd, $J = 12.7, 6.7$ Hz, 1H), 1.59 (dd, $J = 12.7, 8.6$ Hz, 1H), 1.37 (s, 3H), 1.35 (s, 3H), 1.35 (s, 9H) ppm.

^{13}C NMR (101 MHz, Chloroform- d) $\delta = 198.6, 180.3, 157.0, 134.8, 134.6, 129.6, 128.3$ (4C), 128.0 (2C), 125.7 (2C), 64.6, 50.9, 48.8, 46.0, 35.2, 31.2 (3C), 27.5, 26.1 ppm.

HRMS (ESI) m/z calculated for $\text{C}_{24}\text{H}_{29}\text{NONa}^+$ $[\text{M}+\text{Na}]^+$: 370.2141, found: 370.2147.

HPLC-Data: 93% ee , (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_R = 16.9$ (major), 22.4 (minor).

(*S*)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-1-(4-fluorophenyl)ethan-1-one (3ka)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (43.2 mg, 70% yield).

^1H NMR (400 MHz, Chloroform- d) $\delta = 8.09 - 8.01$ (m, 2H), 7.68 (d, $J = 7.9$ Hz, 2H), 7.43 – 7.34 (m, 3H), 7.18 – 7.11 (m, 2H), 4.63 – 4.52 (m, 1H), 3.78 (dd, $J = 16.7, 4.6$ Hz, 1H), 3.03 (dd, $J = 16.7, 9.2$ Hz, 1H), 2.34 (dd, $J = 12.6, 6.7$ Hz, 1H), 1.59 (dd, $J = 12.7, 8.8$ Hz, 1H), 1.38 (s, 3H), 1.36 (s, 3H) ppm.

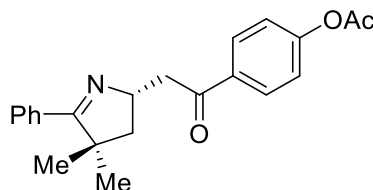
^{13}C NMR (101 MHz, Chloroform- d) $\delta = 197.4, 180.4, 165.9$ (d, $J = 254.8$ Hz), 134.7, 133.6 (d, $J = 3.0$ Hz), 131.0 (d, $J = 9.3$ Hz, 2C), 129.7, 128.3 (2C), 128.0 (2C), 115.8 (d, $J = 21.9$ Hz, 2C), 64.5, 50.9, 48.8, 45.9, 27.5, 26.0 ppm.

^{19}F NMR (376 MHz, Chloroform- d) $\delta = -105.21$ (s, 1F) ppm.

HRMS (ESI) m/z calculated for $\text{C}_{20}\text{H}_{20}\text{FNONa}^+$ $[\text{M}+\text{Na}]^+$: 332.1421, found: 332.1422.

HPLC-Data: 92% ee , (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_R = 14.7$ (major), 22.4 (minor).

**(S)-4-(2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)acetyl)phenyl acetate
(3la)**



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 3:1) as a colorless oil (51.6 mg, 74% yield).

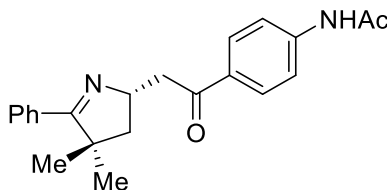
¹H NMR (500 MHz, Chloroform-*d*) δ = 8.06 (d, J = 8.7 Hz, 2H), 7.68 (d, J = 8.1 Hz, 2H), 7.42 – 7.35 (m, 3H), 7.20 (d, J = 8.7 Hz, 2H), 4.66 – 4.57 (m, 1H), 3.83 (dd, J = 16.7, 4.5 Hz, 1H), 3.04 (dd, J = 16.8, 9.5 Hz, 1H), 2.36 (dd, J = 12.6, 6.7 Hz 1H), 2.33 (s, 3H), 1.60 (dd, J = 12.7, 8.7 Hz, 1H), 1.38 (s, 3H), 1.36 (s, 3H) ppm.

¹³C NMR (126 MHz, Chloroform-*d*) δ = 197.6, 180.8, 169.0, 154.5, 134.7, 134.6, 130.0 (2C), 129.8, 128.4 (2C), 128.0 (2C), 122.0 (2C), 64.4, 51.0, 48.6, 45.9, 27.5, 26.0, 21.3 ppm.

HRMS (ESI) m/z calculated for C₂₂H₂₃NO₃H⁺ [M+H]⁺: 350.1751, found: 350.1757.

HPLC-Data: 94% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): t_R = 22.7 (minor), 24.5 (major).

(S)-N-(4-(2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)acetyl)phenyl)-acetamide (3ma)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 1:1) as a white solid (32.0 mg, 46% yield).

¹H NMR (400 MHz, Chloroform-*d*) δ = 7.93 (d, J = 8.4 Hz, 2H), 7.66 (d, J = 7.9 Hz, 2H), 7.59 (d, J = 8.4 Hz, 2H), 7.43 – 7.32 (m, 3H), 4.66 – 4.56 (m, 1H), 3.73 (dd, J = 16.6, 5.1 Hz, 1H), 3.01 (dd, J = 16.6, 8.8 Hz, 1H), 2.32 (dd, J = 12.6, 6.7 Hz, 1H), 2.14 (s, 3H), 1.61 (dd, J = 12.7, 8.8 Hz, 1H), 1.37 (s, 3H), 1.35 (s, 3H) ppm.

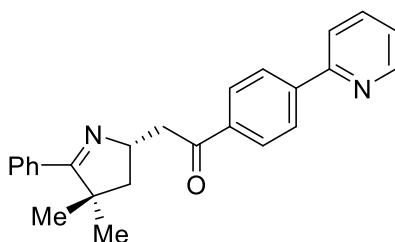
¹³C NMR (101 MHz, Chloroform-*d*) δ = 197.6, 180.7, 168.8, 142.6, 134.7, 132.7,

129.69 (2C), 129.73 (2C), 128.4 (2C), 127.9 (2C), 119.0, 64.5, 50.9, 48.6, 45.7, 27.4, 26.0, 24.8 ppm.

HRMS (ESI) m/z calculated for $C_{22}H_{24}N_2O_2H^+$ $[M+H]^+$: 349.1911, found: 349.1921.

HPLC-Data: 90% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 80/20, flow rate = 0.5 mL/min): $t_R = 11.9$ (major), 14.3 (minor).

(S)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-1-(4-(pyridin-2-yl)-phenyl)ethan-1-one (3na)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 2:1) as a white solid (28.7 mg, 39% yield).

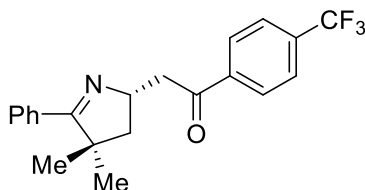
1H NMR (400 MHz, Chloroform-*d*) $\delta = 8.74$ (d, $J = 4.8$ Hz, 1H), 8.17 – 8.09 (m, 4H), 7.80 (d, $J = 4.5$ Hz, 2H), 7.70 (d, $J = 7.8$ Hz, 2H), 7.43 – 7.35 (m, 3H), 7.33 – 7.27 (m, 1H), 4.68 – 4.58 (m, 1H), 3.89 (dd, $J = 16.8, 4.5$ Hz, 1H), 3.10 (dd, $J = 16.7, 9.4$ Hz, 1H), 2.37 (dd, $J = 12.7, 6.7$ Hz, 1H), 1.63 (dd, $J = 12.7, 8.8$ Hz, 1H), 1.39 (s, 3H), 1.37 (s, 3H) ppm.

^{13}C NMR (101 MHz, Chloroform-*d*) $\delta = 198.6, 180.4, 156.2, 150.1, 143.7, 137.2, 137.1, 134.8, 129.7, 128.9$ (2C), 128.3 (2C), 128.0 (2C), 127.2 (2C), 123.1, 121.2, 64.5, 51.0, 48.8, 46.2, 27.5, 26.0 ppm.

HRMS (ESI) m/z calculated for $C_{25}H_{24}N_2OH^+$ $[M+H]^+$: 369.1961, found: 369.1972.

HPLC-Data: 97% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 80/20, flow rate = 0.5 mL/min): $t_R = 24.4$ (major), 32.9 (minor).

(S)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-1-(4-(trifluoromethyl)-phenyl)ethan-1-one (30a)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (24.2 mg, 34% yield).

$^1\text{H NMR}$ (400 MHz, Chloroform-*d*) δ = 8.12 (d, J = 8.1 Hz, 2H), 7.75 (d, J = 8.2 Hz, 2H), 7.67 (d, J = 8.0 Hz, 2H), 7.42 – 7.34 (m, 3H), 4.66 – 4.53 (m, 1H), 3.80 (dd, J = 16.8, 4.9 Hz, 1H), 3.09 (dd, J = 16.8, 8.9 Hz, 1H), 2.35 (dd, J = 12.7, 6.7 Hz, 1H), 1.61 (dd, J = 12.7, 8.8 Hz, 1H), 1.39 (s, 3H), 1.36 (s, 3H) ppm.

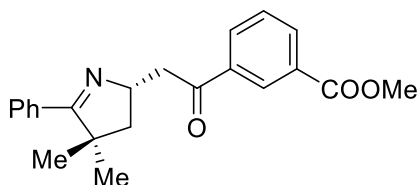
$^{13}\text{C NMR}$ (101 MHz, Chloroform-*d*) δ = 198.0, 180.5, 139.9, 134.7, 134.5 (q, J = 32.7 Hz), 129.8, 128.7 (2C), 128.4 (2C), 128.0 (2C), 125.8 (q, J = 3.8 Hz, 2C), 123.8 (q, J = 272.7 Hz), 64.4, 51.0, 48.8, 46.3, 27.5, 26.0 ppm.

$^{19}\text{F NMR}$ (376 MHz, Chloroform-*d*) δ = -63.09 (s, 3F) ppm.

HRMS (ESI) m/z calculated for $\text{C}_{21}\text{H}_{20}\text{F}_3\text{NOH}^+$ $[\text{M}+\text{H}]^+$: 360.1570, found: 360.1582.

HPLC-Data: 77% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): t_{R} = 12.2 (major), 23.0 (minor).

Methyl (S)-3-(2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)acetyl)-benzoate (3pa)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 3:1) as a yellow oil (38.4 mg, 55% yield).

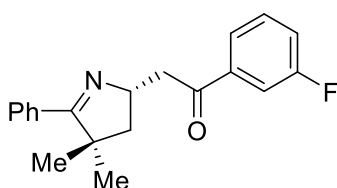
$^1\text{H NMR}$ (400 MHz, Chloroform-*d*) δ = 8.67 (s, 1H), 8.28 – 8.18 (m, 2H), 7.69 (d, J = 7.8 Hz, 2H), 7.57 (t, J = 7.8 Hz, 1H), 7.43 – 7.33 (m, 3H), 4.66 – 4.55 (m, 1H), 3.96 (s, 3H), 3.84 (dd, J = 16.7, 4.9 Hz, 1H), 3.10 (dd, J = 16.8, 9.0 Hz, 1H), 2.35 (dd, J = 12.7, 6.7 Hz, 1H), 1.61 (dd, J = 12.6, 8.8 Hz, 1H), 1.39 (s, 3H), 1.37 (s, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 198.2, 180.4, 166.4, 137.5, 134.7, 134.1, 132.4, 130.9, 129.7, 129.6, 129.0, 128.3 (2C), 128.0 (2C), 64.5, 52.5, 51.0, 48.8, 46.1, 27.5, 26.0 ppm.

HRMS (ESI) *m/z* calculated for C₂₂H₂₃NO₃Na⁺ [M+Na]⁺: 372.1570, found: 372.1570.

HPLC-Data: 56% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 80/20, flow rate = 0.5 mL/min): *t_R* = 10.7 (major), 12.4 (minor).

(*S*)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-1-(3-fluorophenyl)-ethan-1-one (3qa)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (24.1 mg, 39% yield).

¹H NMR (400 MHz, Chloroform-*d*) δ = 7.81 (d, *J* = 7.8 Hz, 1H), 7.73 – 7.66 (m, 3H), 7.50 – 7.43 (m, 1H), 7.42 – 7.34 (m, 3H), 7.30 – 7.25 (m, 1H), 4.64 – 4.54 (m, 1H), 3.78 (dd, *J* = 16.8, 4.7 Hz, 1H), 3.04 (dd, *J* = 16.8, 9.1 Hz, 1H), 2.35 (dd, *J* = 12.6, 6.7 Hz, 1H), 1.59 (dd, *J* = 12.7, 8.8 Hz, 1H), 1.38 (s, 3H), 1.36 (s, 3H) ppm.

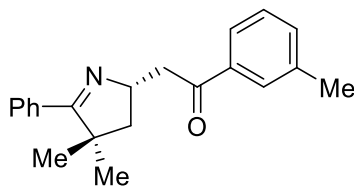
¹³C NMR (101 MHz, Chloroform-*d*) δ = 197.7 (d, *J* = 2.1 Hz), 180.5, 163.0 (d, *J* = 247.7 Hz), 139.3 (d, *J* = 6.1 Hz), 134.7, 130.4 (d, *J* = 7.6 Hz), 129.7, 128.3 (2C), 128.0 (2C), 124.1 (d, *J* = 3.0 Hz), 120.3 (d, *J* = 21.5 Hz), 115.1 (d, *J* = 22.3 Hz), 64.4, 51.0, 48.8, 46.2, 27.5, 26.0 ppm.

¹⁹F NMR (376 MHz, Chloroform-*d*) δ = -111.84 (s, 1F) ppm.

HRMS (ESI) *m/z* calculated for C₂₀H₂₀FNONa⁺ [M+Na]⁺: 332.1421, found: 332.1427.

HPLC-Data: 87% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): *t_R* = 14.3 (major), 18.0 (minor).

(S)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-1-(*m*-tolyl)ethan-1-one
(3ra)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (28.7 mg, 47% yield).

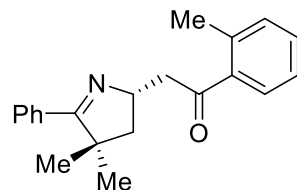
¹H NMR (400 MHz, Chloroform-*d*) δ = 7.86 – 7.80 (m, 2H), 7.69 (d, J = 7.9 Hz, 2H), 7.41 – 7.34 (m, 5H), 4.67 – 4.53 (m, 1H), 3.83 (dd, J = 16.7, 4.4 Hz, 1H), 3.04 (dd, J = 16.7, 9.6 Hz, 1H), 2.42 (s, 3H), 2.34 (dd, J = 12.7, 6.8 Hz, 1H), 1.59 (dd, J = 12.7, 8.7 Hz, 1H), 1.38 (s, 3H), 1.36 (s, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 199.2, 180.3, 138.5, 137.2, 134.8, 134.0, 129.6, 128.9, 128.6, 128.3 (2C), 128.0 (2C), 125.6, 64.6, 50.9, 48.8, 46.2, 27.5, 26.1, 21.5 ppm.

HRMS (ESI) m/z calculated for C₂₁H₂₃NONa⁺ [M+Na]⁺: 306.1852, found: 306.1861.

HPLC-Data: 96% *ee*, (Chiralpak IA column, λ = 254 nm, hexane/isopropanol = 70/30, flow rate = 1.0 mL/min): t_R = 4.1 (major), 4.7 (minor).

(S)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-1-(*o*-tolyl)ethan-1-one
(3sa)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (36.0 mg, 59% yield).

¹H NMR (500 MHz, Chloroform-*d*) δ = 7.74 (d, J = 7.8 Hz, 1H), 7.69 (d, J = 8.0 Hz, 2H), 7.40 – 7.35 (m, 4H), 7.29 – 7.25 (m, 2H), 4.60 – 4.53 (m, 1H), 3.73 (dd, J = 16.5, 4.9 Hz, 1H), 3.00 (dd, J = 16.6, 9.3 Hz, 1H), 2.54 (s, 3H), 2.33 (dd, J = 12.6, 6.7 Hz, 1H), 1.59 (dd, J = 12.6, 8.7 Hz, 1H), 1.38 (s, 3H), 1.36 (s, 3H) ppm.

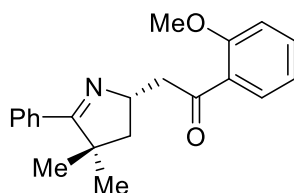
¹³C NMR (126 MHz, Chloroform-*d*) δ = 203.0, 180.1, 138.4, 138.0, 134.8, 132.1,

131.5, 129.6, 128.9, 128.3 (2C), 128.0 (2C), 125.9, 64.7, 50.9, 48.9, 48.8, 27.5, 26.1, 21.6 ppm.

HRMS (ESI) m/z calculated for $C_{21}H_{23}NOH^+$ $[M+H]^+$: 306.1852, found: 306.1861.

HPLC-Data: 90% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_R = 15.7$ (major), 18.0 (minor).

(S)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-1-(2-methoxyphenyl)-ethan-1-one (3ta)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 3:1) as a colorless oil (28.3 mg, 44% yield).

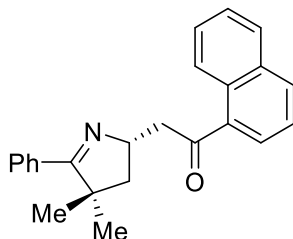
1H NMR (400 MHz, Chloroform-*d*) $\delta = 7.75$ (d, $J = 7.7$ Hz, 1H), 7.68 (d, $J = 7.7$ Hz, 2H), 7.46 (t, $J = 7.9$ Hz, 1H), 7.40 – 7.35 (m, 3H), 7.05 – 6.95 (m, 2H), 4.62 – 4.53 (m, 1H), 3.91 (s, 3H), 3.85 (dd, $J = 17.1, 4.3$ Hz, 1H), 3.11 (dd, $J = 17.4, 9.7$ Hz, 1H), 2.32 (dd, $J = 12.7, 6.8$ Hz, 1H), 1.57 (dd, $J = 12.7, 8.6$ Hz, 1H), 1.36 (s, 3H), 1.34 (s, 3H) ppm.

^{13}C NMR (101 MHz, Chloroform-*d*) $\delta = 201.0, 180.0, 158.8, 135.0, 133.6, 130.5, 129.5, 128.5, 128.3$ (2C), 128.0 (2C), 120.7, 111.6, 64.7, 55.6, 51.3, 50.8, 48.7, 27.5, 26.1 ppm.

HRMS (ESI) m/z calculated for $C_{21}H_{23}NO_2H^+$ $[M+H]^+$: 322.1802, found: 322.1807.

HPLC-Data: 92% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): $t_R = 15.5$ (major), 17.2 (minor).

(S)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-1-(naphthalen-1-yl)-ethan-1-one (3ua)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) as a colorless oil (22.5 mg, 33% yield).

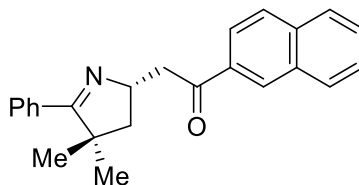
¹H NMR (400 MHz, Chloroform-*d*) δ = 8.68 (d, J = 8.5 Hz, 1H), 8.00 (m, 2H), 7.89 (d, J = 8.1 Hz, 1H), 7.69 (d, J = 8.0 Hz, 2H), 7.61 (t, J = 7.8 Hz, 1H), 7.57 – 7.50 (m, 2H), 7.42 – 7.35 (m, 3H), 4.70 – 4.61 (m, 1H), 3.90 (dd, J = 16.3, 5.0 Hz, 1H), 3.15 (dd, J = 16.3, 9.2 Hz, 1H), 2.36 (dd, J = 12.6, 6.7 Hz, 1H), 1.67 (dd, J = 12.6, 8.8 Hz, 1H), 1.39 (s, 3H), 1.37 (s, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 203.3, 180.2, 136.1, 134.7, 134.1, 132.9, 130.3, 129.7, 128.6, 128.3 (2C), 128.1 (2C), 128.0 (2C), 126.6, 126.0, 124.6, 64.9, 51.0, 49.4, 48.7, 27.5, 26.1 ppm.

HRMS (ESI) m/z calculated for C₂₄H₂₃NONa⁺ [M+Na]⁺: 364.1672, found: 364.1674.

HPLC-Data: 97% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): t_R = 16.3 (major), 20.9 (minor).

(S)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-1-(naphthalen-2-yl)-ethan-1-one (3va)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (38.2 mg, 56% yield).

¹H NMR (400 MHz, Chloroform-*d*) δ = 8.57 (s, 1H), 8.10 (d, J = 8.6 Hz, 1H), 7.98 (d, J = 7.5 Hz, 1H), 7.93 – 7.87 (m, 2H), 7.71 (d, J = 7.9 Hz, 2H), 7.63 – 7.54 (m, 2H), 7.42 – 7.35 (m, 3H), 4.71 – 4.61 (m, 1H), 3.99 (dd, J = 16.5, 4.5 Hz, 1H), 3.19 (dd, J =

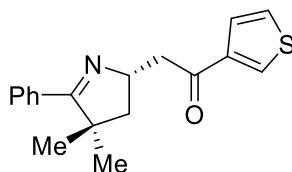
16.5, 9.5 Hz, 1H), 2.38 (dd, $J = 12.7, 6.7$ Hz, 1H), 1.66 (dd, $J = 12.7, 8.7$ Hz, 1H), 1.40 (s, 3H), 1.38 (s, 3H) ppm.

^{13}C NMR (101 MHz, Chloroform- d) $\delta = 198.9, 180.3, 135.7, 134.8, 134.5, 132.7, 130.2, 129.8, 129.7, 128.62, 128.59, 128.3$ (2C), 128.0 (2C), 127.9, 126.9, 124.0, 64.7, 51.0, 48.8, 46.2, 27.5, 26.1 ppm.

HRMS (ESI) m/z calculated for $\text{C}_{24}\text{H}_{23}\text{NONa}^+$ $[\text{M}+\text{Na}]^+$: 364.1672, found: 364.1676.

HPLC-Data: 96% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): $t_{\text{R}} = 17.4$ (minor), 23.0 (major).

(*S*)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)-1-(thiophen-3-yl)-ethan-1-one (3wa)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) as a yellow oil (29.1 mg, 49% yield).

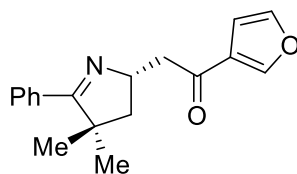
^1H NMR (400 MHz, Chloroform- d) $\delta = 8.16 - 8.10$ (m, 1H), 7.68 (d, $J = 7.9$ Hz, 2H), 7.59 (d, $J = 5.1$ Hz, 1H), 7.42 – 7.35 (m, 3H), 7.35 – 7.31 (m, 1H), 4.62 – 4.51 (m, 1H), 3.73 (dd, $J = 16.3, 4.6$ Hz, 1H), 2.98 (dd, $J = 16.3, 9.5$ Hz, 1H), 2.33 (dd, $J = 12.7, 6.7$ Hz, 1H), 1.61 (dd, $J = 12.7, 8.8$ Hz, 1H), 1.37 (s, 3H), 1.36 (s, 3H) ppm.

^{13}C NMR (101 MHz, Chloroform- d) $\delta = 193.3, 180.4, 142.6, 134.7, 132.5, 129.7, 128.3$ (2C), 128.0 (2C), 127.1, 126.5, 64.5, 51.0, 48.7, 47.2, 27.5, 26.0 ppm.

HRMS (ESI) m/z calculated for $\text{C}_{18}\text{H}_{19}\text{NOSNa}^+$ $[\text{M}+\text{Na}]^+$: 320.1080, found: 320.1086.

HPLC-Data: 95% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): $t_{\text{R}} = 14.5$ (minor), 15.4 (major).

(S)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-1-(furan-3-yl)ethan-1-one (3xa)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 3:1) as a colorless oil (19.6 mg, 35% yield).

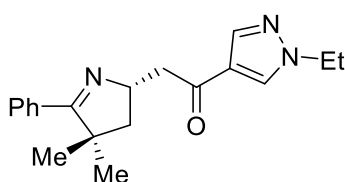
¹H NMR (400 MHz, Chloroform-*d*) δ = 8.11 (s, 1H), 7.74 (d, *J* = 7.2 Hz, 2H), 7.49 – 7.35 (m, 4H), 6.81 (s, 1H), 4.64 – 4.51 (m, 1H), 3.65 (dd, *J* = 15.9, 4.5 Hz, 1H), 2.88 (dd, *J* = 16.1, 9.3 Hz, 1H), 2.34 (dd, *J* = 12.7, 6.7 Hz, 1H), 1.65 (dd, *J* = 12.7, 8.9 Hz, 1H), 1.40 (s, 3H), 1.38 (s, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 193.4, 181.3, 147.8, 144.4, 133.7, 130.4, 128.5 (2C), 128.3 (2C), 128.1, 108.7, 63.9, 50.9, 48.4, 47.3, 27.4, 26.1 ppm.

HRMS (ESI) *m/z* calculated for C₁₈H₁₉NO₂Na⁺ [M+Na]⁺: 304.1308, found: 304.1314.

HPLC-Data: 99% *ee*, (Chiralpak AD-H column, λ = 254 nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): *t_R* = 13.1 (major), 15.9 (minor).

(S)-2-(4,4-Dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-1-(1-ethyl-1H-pyrazol-4-yl)ethan-1-one (3ya)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 1:1) as a yellow oil (26.6 mg, 43% yield).

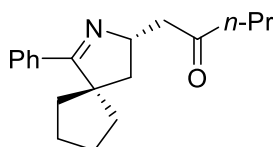
¹H NMR (400 MHz, Chloroform-*d*) δ = 7.98 – 7.94 (m, 2H), 7.70 – 7.64 (m, 2H), 7.41 – 7.33 (m, 3H), 4.57 – 4.48 (m, 1H), 4.20 (q, *J* = 7.3 Hz, 2H), 3.53 (dd, *J* = 15.7, 5.0 Hz, 1H), 2.84 (dd, *J* = 15.7, 9.2 Hz, 1H), 2.28 (dd, *J* = 12.7, 6.7 Hz, 1H), 1.61 (dd, *J* = 12.7, 8.8 Hz, 1H), 1.52 (t, *J* = 7.3 Hz, 3H), 1.36 (s, 3H), 1.34 (s, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 193.2, 180.3, 140.5, 134.8, 131.1, 129.7, 128.3 (2C), 128.0 (2C), 124.2, 64.6, 50.9, 48.6, 47.68, 47.65, 27.4, 26.0, 15.3 ppm.

HRMS (ESI) m/z calculated for $C_{19}H_{23}N_3OH^+$ $[M+H]^+$: 310.1914, found: 310.1924.

HPLC-Data: 90% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 80/20, flow rate = 0.5 mL/min): $t_R = 12.0$ (minor), 14.2 (major).

(S)-1-(1-Phenyl-2-azaspiro[4.4]non-1-en-3-yl)pentan-2-one (3ab)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (29.5 mg, 52% yield).

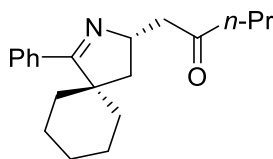
1H NMR (500 MHz, Chloroform-*d*) $\delta = 7.62$ (d, $J = 7.9$ Hz, 2H), 7.40 – 7.33 (m, 3H), 4.41 – 4.33 (m, 1H), 3.13 (dd, $J = 16.4, 5.3$ Hz, 1H), 2.54 (dd, $J = 16.4, 8.8$ Hz, 1H), 2.51 – 2.41 (m, 2H), 2.32 (dd, $J = 12.5, 6.7$ Hz, 1H), 2.24 – 2.14 (m, 1H), 1.91 – 1.84 (m, 1H), 1.84 – 1.75 (m, 3H), 1.74 – 1.68 (m, 2H), 1.67 – 1.60 (m, 2H), 1.56 – 1.50 (m, 1H), 1.42 (dd, $J = 12.5, 8.4$ Hz, 1H), 0.93 (t, $J = 7.4$ Hz, 3H) ppm.

^{13}C NMR (126 MHz, Chloroform-*d*) $\delta = 210.2, 179.5, 134.6, 129.6, 128.3$ (2C), 128.0 (2C), 64.8, 61.1, 49.7, 48.5, 45.6, 37.9, 36.2, 25.8, 25.3, 17.3, 13.9 ppm.

HRMS (ESI) m/z calculated for $C_{19}H_{25}NONa^+$ $[M+Na]^+$: 306.1828, found: 306.1829.

HPLC-Data: 96% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_R = 13.8$ (minor), 16.3 (major).

(S)-1-(1-Phenyl-2-azaspiro[4.5]dec-1-en-3-yl)pentan-2-one (3ac)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) as a colorless oil (44.6 mg, 75% yield).

1H NMR (400 MHz, Chloroform-*d*) $\delta = 7.51$ (d, $J = 7.5$ Hz, 2H), 7.41 – 7.31 (m, 3H), 4.46 – 4.35 (m, 1H), 3.13 (dd, $J = 16.5, 5.1$ Hz, 1H), 2.59 – 2.42 (m, 4H), 1.84 – 1.75 (m, 1H), 1.73 – 1.55 (m, 7H), 1.51 – 1.41 (m, 2H), 1.33 (dd, $J = 13.0, 8.6$ Hz, 1H), 1.29 – 1.22 (m, 1H), 1.20 – 1.10 (m, 1H), 0.93 (t, $J = 7.4$ Hz, 3H) ppm.

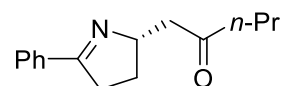
^{13}C NMR (101 MHz, Chloroform-*d*) $\delta = 210.0, 181.1, 135.7, 129.1, 128.1$ (4C), 64.9,

56.8, 50.2, 45.6, 41.7, 36.0, 31.8, 25.7, 23.4, 23.2, 17.3, 13.9 ppm.

HRMS (ESI) m/z calculated for $C_{20}H_{27}NOH^+$ $[M+H]^+$: 298.2165, found: 298.2169.

HPLC-Data: 95% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): $t_R = 11.1$ (minor), 12.0 (major).

(S)-1-(5-Phenyl-3,4-dihydro-2H-pyrrol-2-yl)pentan-2-one (3ad)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) as a yellow oil (11.0 mg, 24% yield).

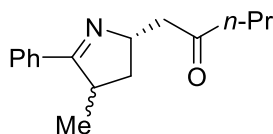
1H NMR (400 MHz, Chloroform-*d*) $\delta = 7.82$ (d, $J = 8.0$ Hz, 2H), 7.46 – 7.37 (m, 3H), 4.64 – 4.54 (m, 1H), 3.09 – 3.00 (m, 2H), 2.97 – 2.87 (m, 1H), 2.58 – 2.45 (m, 3H), 2.40 – 2.32 (m, 1H), 1.67 – 1.61 (m, 2H), 1.60 – 1.53 (m, 1H), 0.93 (t, $J = 7.4$ Hz, 3H) ppm.

^{13}C NMR (101 MHz, Chloroform-*d*) $\delta = 210.1$, 173.0, 134.5, 130.7, 128.6 (2C), 127.8 (2C), 69.2, 49.6, 45.6, 35.3, 29.2, 17.4, 13.9 ppm.

HRMS (ESI) m/z calculated for $C_{15}H_{19}NOH^+$ $[M+H]^+$: 230.1539, found: 230.1541.

HPLC-Data: 66% *ee*, (Chiralpak AD-H column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_R = 17.8$ (major), 23.1 (minor).

1-((2S)-4-Methyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)pentan-2-one (3ae)



The mixture of title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (17.4 mg, 36% yield, *dr* = 62:38).

1H NMR (400 MHz, Chloroform-*d*) δ (mixture of two diastereomers) = 7.75 (d, $J = 5.3$ Hz, 1.2H), [7.65 (d, $J = 4.9$ Hz, 0.8H)], 7.42 – 7.29 (m, 3H), 4.54 – 4.41 (m, 1H), 3.46 – 3.35 (m, 1H), 3.09 – 2.97 (m, 1H), [2.62 – 2.54 (m, 0.4H)], 2.52 – 2.47 (m, 0.6H), 2.46 – 2.35 (m, 2H), 2.03 – 1.94 (m, 1H), 1.73 – 1.64 (m, 1H), 1.61 – 1.53 (m, 2H), [1.15 (d, $J = 7.3$ Hz, 1.2H)], 1.11 (d, $J = 7.2$ Hz, 1.8H), 0.86 (t, $J = 7.0$ Hz, 3H) ppm

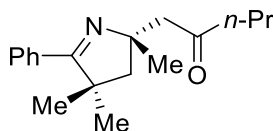
(peaks in brackets are for the minor diastereomer).

^{13}C NMR (101 MHz, Chloroform-*d*) δ (mixture of two diastereomers) = 210.2, [210.0], 177.2, 133.5, 130.5, [130.2], 128.7 (2C), [128.5 (2C)], 128.2 (2C), [128.1 (2C)], [67.3], 66.7, [50.6], 49.8, 45.63, [45.56], [42.7], 42.2, 39.0, [38.2], [20.6], 18.3, 17.4, 13.9 ppm (peaks in brackets are for the minor diastereomer).

HRMS (ESI) m/z calculated for $\text{C}_{16}\text{H}_{21}\text{NOH}^+$ $[\text{M}+\text{H}]^+$: 244.1696, found: 292.1699.

HPLC-Data: 40% *ee* (major diastereomer), 42% *ee* (minor diastereomer), (Chiral AD-H column, $\lambda = 254$ nm, hexane/isopropanol = 98/2, flow rate = 0.5 mL/min): $t_{\text{R}} = 29.3$ (major enantiomer, minor diastereomer), 33.4 (major enantiomer, major diastereomer), 39.0 (minor enantiomer, major diastereomer), 41.3 (minor enantiomer, minor diastereomer).

(*S*)-1-(2,4,4-Trimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)pentan-2-one (3af)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (23.3 mg, 43% yield).

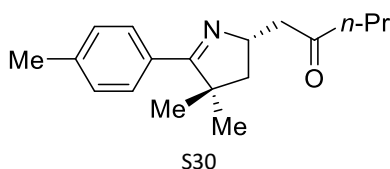
^1H NMR (400 MHz, Chloroform-*d*) $\delta = 7.65$ (d, $J = 7.8$ Hz, 2H), 7.40 – 7.33 (m, 3H), 2.84 (d, $J = 15.3$ Hz, 1H), 2.72 (d, $J = 15.3$ Hz, 1H), 2.49 – 2.40 (m, 2H), 2.18 (d, $J = 13.4$ Hz, 1H), 1.94 (d, $J = 13.4$ Hz, 1H), 1.63 – 1.53 (m, 2H), 1.41 (s, 3H), 1.39 (s, 3H), 1.31 (s, 3H), 0.90 (t, $J = 7.4$ Hz, 3H) ppm.

^{13}C NMR (101 MHz, Chloroform-*d*) $\delta = 210.3$, 177.7, 135.1, 129.4, 128.3 (2C), 128.1 (2C), 70.8, 54.8, 51.8 (2C), 46.7, 29.2 (2C), 28.5, 17.3, 13.9 ppm.

HRMS (ESI) m/z calculated for $\text{C}_{18}\text{H}_{25}\text{NOH}^+$ $[\text{M}+\text{H}]^+$: 272.2009, found: 272.2011.

HPLC-Data: 54% *ee*, (Chiral AD-H column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_{\text{R}} = 8.3$ (major), 8.9 (minor).

(*S*)-1-(4,4-Dimethyl-5-(*p*-tolyl)-3,4-dihydro-2*H*-pyrrol-2-yl)pentan-2-one (3ag)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) as a colorless oil (34.7 mg, 64% yield).

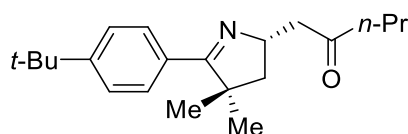
¹H NMR (400 MHz, Chloroform-*d*) δ = 7.60 (d, J = 8.2 Hz, 2H), 7.17 (d, J = 7.9 Hz, 2H), 4.43 – 4.34 (m, 1H), 3.11 (dd, J = 16.3, 5.4 Hz, 1H), 2.53 (dd, J = 16.3, 8.6 Hz, 1H), 2.54 – 2.42 (m, 2H), 2.36 (s, 3H), 2.22 (dd, J = 12.6, 6.7 Hz, 1H), 1.69 – 1.59 (m, 2H), 1.48 (dd, J = 12.6, 8.7 Hz, 1H), 1.35 (s, 3H), 1.34 (s, 3H), 0.93 (t, J = 7.4 Hz, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 210.2, 179.8, 139.8, 131.8, 129.0 (2C), 128.0 (2C), 64.0, 50.7, 49.9, 48.8, 45.7, 27.5, 26.0, 21.5, 17.3, 13.9 ppm.

HRMS (ESI) m/z calculated for C₁₈H₂₅NOH⁺ [M+H]⁺: 272.2009, found: 272.2010.

HPLC-Data: 98% *ee*, (Chiralpak AD-H column, λ = 254 nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): t_R = 11.7 (major), 12.3 (minor).

(S)-1-(5-(4-(*tert*-Butyl)phenyl)-4,4-dimethyl-3,4-dihydro-2H-pyrrol-2-yl)pentan-2-one (3ah)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 6:1) as a colorless oil (35.2 mg, 56% yield).

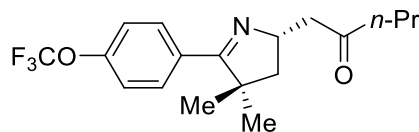
¹H NMR (400 MHz, Chloroform-*d*) δ = 7.64 (d, J = 8.5 Hz, 2H), 7.37 (d, J = 8.5 Hz, 2H), 4.43 – 4.34 (m, 1H), 3.10 (dd, J = 16.2, 5.4 Hz, 1H), 2.52 (dd, J = 16.2, 8.7 Hz, 1H), 2.53 – 2.42 (m, 2H), 2.22 (dd, J = 12.5, 6.8 Hz, 1H), 1.69 – 1.58 (m, 2H), 1.48 (dd, J = 12.6, 8.7 Hz, 1H), 1.36 (s, 3H), 1.35 (s, 3H), 1.31 (s, 9H), 0.93 (t, J = 7.4 Hz, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 210.2, 179.6, 152.8, 131.7, 127.8 (2C), 125.2 (2C), 64.0, 50.6, 49.9, 48.7, 45.6, 34.8, 31.3 (3C), 27.6, 26.0, 17.3, 13.9 ppm.

HRMS (ESI) m/z calculated for C₂₁H₃₁NONa⁺ [M+Na]⁺: 314.2478, found: 314.2484.

HPLC-Data: 90% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): t_R = 9.2 (major), 10.9 (minor).

(S)-1-(4,4-Dimethyl-5-(4-(trifluoromethoxy)phenyl)-3,4-dihydro-2H-pyrrol-2-yl)pentan-2-one (3ai)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) as a colorless oil (49.8 mg, 73% yield).

¹H NMR (500 MHz, Chloroform-*d*) δ = 7.72 (d, J = 8.8 Hz, 2H), 7.20 (d, J = 8.8 Hz, 2H), 4.44 – 4.37 (m, 1H), 3.07 (dd, J = 16.5, 5.6 Hz, 1H), 2.54 (dd, J = 16.5, 8.5 Hz, 1H), 2.50 – 2.40 (m, 2H), 2.24 (dd, J = 12.6, 6.8 Hz, 1H), 1.67 – 1.59 (m, 2H), 1.50 (dd, J = 12.7, 8.9 Hz, 1H), 1.33 (s, 3H), 1.32 (s, 3H), 0.92 (t, J = 7.4 Hz, 3H) ppm.

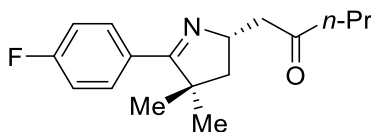
¹³C NMR (126 MHz, Chloroform-*d*) δ = 209.8, 178.7, 150.2 (q, J = 1.9 Hz), 133.2, 129.7 (2C), 120.6 (2C), 120.5 (q, J = 257.7 Hz), 64.2, 50.7, 49.6, 48.6, 45.6, 27.3, 25.8, 17.3, 13.8 ppm.

¹⁹F NMR (471 MHz, Chloroform-*d*) δ = -57.76 (s, 3F) ppm.

HRMS (ESI) m/z calculated for C₁₈H₂₂F₃NO₂H⁺ [M+H]⁺: 342.1675, found: 342.1678.

HPLC-Data: 90% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): t_R = 7.8 (major), 8.5 (minor).

(S)-1-(5-(4-Fluorophenyl)-4,4-dimethyl-3,4-dihydro-2H-pyrrol-2-yl)pentan-2-one (3aj)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (34.1 mg, 62% yield).

¹H NMR (400 MHz, Chloroform-*d*) δ = 7.72 – 7.65 (m, 2H), 7.08 – 7.00 (m, 2H), 4.43 – 4.34 (m, 1H), 3.08 (dd, J = 16.4, 5.5 Hz, 1H), 2.53 (dd, J = 16.5, 8.5 Hz, 1H), 2.50 – 2.40 (m, 2H), 2.23 (dd, J = 12.6, 6.8 Hz, 1H), 1.69 – 1.58 (m, 2H), 1.49 (dd, J = 12.6, 8.8 Hz, 1H), 1.34 (s, 3H), 1.32 (s, 3H), 0.93 (t, J = 7.4 Hz, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 210.0, 178.9, 163.7 (d, J = 249.5 Hz), 130.7

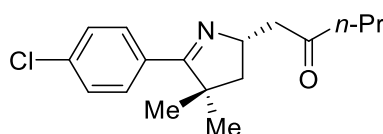
(d, $J = 3.3$ Hz), 130.0 (d, $J = 8.3$ Hz, 2C), 115.3 (d, $J = 21.4$ Hz, 2C), 64.0, 50.6, 49.7, 48.7, 45.6, 27.4, 25.9, 17.3, 13.9 ppm.

^{19}F NMR (376 MHz, Chloroform-*d*) $\delta = -111.34$ (s, 1F) ppm.

HRMS (ESI) m/z calculated for $\text{C}_{17}\text{H}_{22}\text{FNONa}^+ [\text{M}+\text{Na}]^+$: 298.1578, found: 298.1582.

HPLC-Data: 91% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_{\text{R}} = 9.7$ (minor), 10.7 (major).

(*S*)-1-(5-(4-Chlorophenyl)-4,4-dimethyl-3,4-dihydro-2*H*-pyrrol-2-yl)pentan-2-one (3ak)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a yellow oil (38.4 mg, 66% yield).

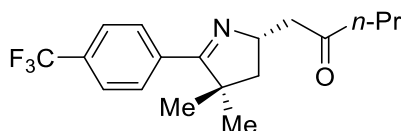
^1H NMR (400 MHz, Chloroform-*d*) $\delta = 7.63$ (d, $J = 8.6$ Hz, 2H), 7.33 (d, $J = 8.6$ Hz, 2H), 4.44 – 4.35 (m, 1H), 3.08 (dd, $J = 16.4, 5.6$ Hz, 1H), 2.53 (dd, $J = 16.5, 8.5$ Hz, 1H), 2.52 – 2.39 (m, 2H), 2.23 (dd, $J = 12.6, 6.7$ Hz, 1H), 1.68 – 1.58 (m, 2H), 1.49 (dd, $J = 12.6, 8.8$ Hz, 1H), 1.33 (s, 3H), 1.31 (s, 3H), 0.92 (t, $J = 7.4$ Hz, 3H) ppm.

^{13}C NMR (101 MHz, Chloroform-*d*) $\delta = 209.9, 178.9, 135.8, 133.1, 129.4$ (2C), 128.5 (2C), 64.2, 50.7, 49.7, 48.6, 45.6, 27.3, 25.9, 17.3, 13.9 ppm.

HRMS (ESI) m/z calculated for $\text{C}_{17}\text{H}_{22}\text{ClNO}_2\text{H}^+ [\text{M}+\text{H}]^+$: 292.1463, found: 292.1466.

HPLC-Data: 98% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_{\text{R}} = 10.0$ (minor), 11.2 (major).

(*S*)-2-(2-([1,1'-Biphenyl]-4-yl)-2-oxo-1-phenylethyl)cyclohex-2-en-1-one (3al)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a yellow oil (32.4 mg, 50% yield).

^1H NMR (400 MHz, Chloroform-*d*) $\delta = 7.77$ (d, $J = 8.1$ Hz, 2H), 7.62 (d, $J = 8.2$ Hz, 2H), 4.48 – 4.40 (m, 1H), 3.09 (dd, $J = 16.5, 5.6$ Hz, 1H), 2.56 (dd, $J = 16.6, 8.4$ Hz,

1H), 2.52 – 2.42 (m, 2H), 2.26 (dd, $J = 12.7, 6.8$ Hz, 1H), 1.69 – 1.59 (m, 2H), 1.52 (dd, $J = 12.6, 8.8$ Hz, 1H), 1.35 (s, 3H), 1.32 (s, 3H), 0.93 (t, $J = 7.4$ Hz, 3H) ppm.

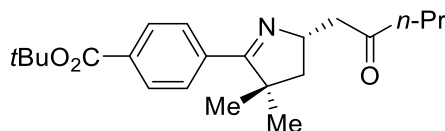
^{13}C NMR (101 MHz, Chloroform-*d*) $\delta = 209.8, 179.1, 138.2, 131.4$ (q, $J = 32.6$ Hz), 128.4 (2C), 125.3 (q, $J = 3.7$ Hz, 2C), 124.1 (q, $J = 272.2$ Hz), 64.5, 50.9, 49.6, 48.5, 45.6, 27.2, 25.8, 17.3, 13.9 ppm.

^{19}F NMR (376 MHz, Chloroform-*d*) $\delta = -62.81$ (s, 3F) ppm.

HRMS (ESI) m/z calculated for $\text{C}_{18}\text{H}_{22}\text{F}_3\text{NOH}^+$ $[\text{M}+\text{H}]^+$: 326.1726, found: 326.1736.

HPLC-Data: 98% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_{\text{R}} = 9.7$ (major), 11.1 (minor).

***tert*-Butyl (S)-4-(4,4-dimethyl-2-(2-oxopentyl)-3,4-dihydro-2H-pyrrol-5-yl)-benzoate (3am)**



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) as a white solid (50.8 mg, 71% yield).

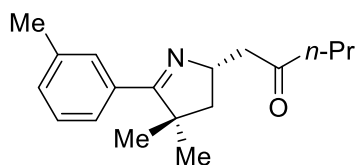
^1H NMR (400 MHz, Chloroform-*d*) $\delta = 7.97$ (d, $J = 8.3$ Hz, 2H), 7.69 (d, $J = 8.3$ Hz, 2H), 4.47 – 4.38 (m, 1H), 3.10 (dd, $J = 16.5, 5.5$ Hz, 1H), 2.55 (dd, $J = 16.6, 8.5$ Hz, 1H), 2.51 – 2.39 (m, 2H), 2.24 (dd, $J = 12.6, 6.8$ Hz, 1H), 1.68 – 1.60 (m, 2H), 1.58 (s, 9H), 1.49 (dd, $J = 12.6, 8.9$ Hz, 1H), 1.34 (s, 3H), 1.29 (s, 3H), 0.92 (t, $J = 7.4$ Hz, 3H) ppm.

^{13}C NMR (101 MHz, Chloroform-*d*) $\delta = 209.9, 179.5, 165.4, 138.5, 132.8, 129.3$ (2C), 127.8 (2C), 81.4, 64.4, 50.9, 49.6, 48.5, 45.6, 28.3 (3C), 27.2, 25.8, 17.3, 13.9 ppm.

HRMS (ESI) m/z calculated for $\text{C}_{22}\text{H}_{31}\text{NO}_3\text{H}^+$ $[\text{M}+\text{H}]^+$: 358.2377, found: 358.2383.

HPLC-Data: 97% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): $t_{\text{R}} = 8.3$ (major), 9.7 (minor).

(S)-1-(4,4-Dimethyl-5-(*m*-tolyl)-3,4-dihydro-2*H*-pyrrol-2-yl)pentan-2-one (3an)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (33.3 mg, 61% yield).

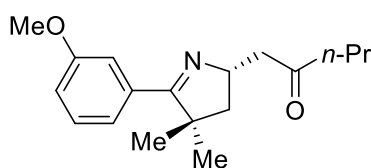
¹H NMR (400 MHz, Chloroform-*d*) δ = 7.50 (s, 1H), 7.45 (d, J = 7.6 Hz, 1H), 7.25 (t, J = 6.9 Hz, 1H), 7.20 (d, J = 7.7 Hz, 1H), 4.45 – 4.36 (m, 1H), 3.13 (dd, J = 16.4, 5.3 Hz, 1H), 2.55 (dd, J = 16.4, 8.8 Hz, 1H), 2.53 – 2.43 (m, 2H), 2.37 (s, 3H), 2.24 (dd, J = 12.6, 6.7 Hz, 1H), 1.70 – 1.59 (m, 2H), 1.49 (dd, J = 12.6, 8.8 Hz, 1H), 1.35 (s, 3H), 1.33 (s, 3H), 0.94 (t, J = 7.4 Hz, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 210.1, 180.3, 138.0, 134.6, 130.4, 128.7, 128.1, 124.8, 64.0, 50.8, 49.8, 48.6, 45.6, 27.4, 26.0, 21.5, 17.3, 13.9 ppm.

HRMS (ESI) m/z calculated for C₁₈H₂₅NONa⁺ [M+Na]⁺: 294.1828, found: 294.1829.

HPLC-Data: 99% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): t_R = 12.1 (minor), 12.9 (major).

(S)-1-(5-(3-Methoxyphenyl)-4,4-dimethyl-3,4-dihydro-2*H*-pyrrol-2-yl)pentan-2-one (3ao)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 3:1) as a yellow oil (41.9 mg, 73% yield).

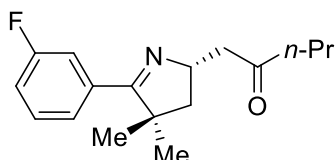
¹H NMR (400 MHz, Chloroform-*d*) δ = 7.31 – 7.22 (m, 3H), 6.97 – 6.92 (m, 1H), 4.45 – 4.36 (m, 1H), 3.83 (s, 3H), 3.12 (dd, J = 16.4, 5.4 Hz, 1H), 2.55 (dd, J = 16.4, 8.6 Hz, 1H), 2.52 – 2.41 (m, 2H), 2.24 (dd, J = 12.6, 6.7 Hz, 1H), 1.70 – 1.60 (m, 2H), 1.50 (dd, J = 12.6, 8.7 Hz, 1H), 1.35 (s, 3H), 1.34 (s, 3H), 0.94 (t, J = 7.4 Hz, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 210.1, 179.9, 159.5, 136.1, 129.3, 120.4, 115.5, 113.4, 64.1, 55.4, 50.8, 49.8, 48.6, 45.7, 27.5, 26.0, 17.3, 13.9 ppm.

HRMS (ESI) m/z calculated for $C_{18}H_{25}NO_2H^+$ $[M+H]^+$: 288.1958, found: 288.1964.

HPLC-Data: 96% *ee*, (Chiralpak IA column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_R = 16.0$ (major), 16.9 (minor).

(S)-1-(5-(3-Fluorophenyl)-4,4-dimethyl-3,4-dihydro-2H-pyrrol-2-yl)pentan-2-one
(3ap)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (39.5 mg, 72% yield).

1H NMR (400 MHz, Chloroform-*d*) $\delta = 7.44$ (d, $J = 7.7$ Hz, 1H), 7.38 (d, $J = 10.1$ Hz, 1H), 7.36 – 7.29 (m, 1H), 7.08 (t, $J = 8.4$ Hz, 1H), 4.45 – 4.36 (m, 1H), 3.08 (dd, $J = 16.4, 5.6$ Hz, 1H), 2.53 (dd, $J = 16.5, 8.5$ Hz, 1H), 2.52 – 2.39 (m, 2H), 2.24 (dd, $J = 12.6, 6.8$ Hz, 1H), 1.69 – 1.58 (m, 2H), 1.50 (dd, $J = 12.6, 8.9$ Hz, 1H), 1.34 (s, 3H), 1.32 (s, 3H), 0.93 (t, $J = 7.4$ Hz, 3H) ppm.

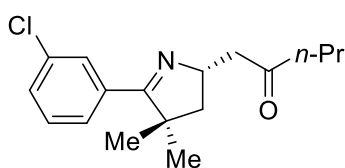
^{13}C NMR (101 MHz, Chloroform-*d*) $\delta = 209.9, 178.9$ (d, $J = 2.4$ Hz), 162.6 (d, $J = 246.0$ Hz), 136.8 (d, $J = 7.4$ Hz), 129.9 (d, $J = 8.1$ Hz), 123.7 (d, $J = 3.0$ Hz), 116.6 (d, $J = 21.2$ Hz), 115.1 (d, $J = 22.5$ Hz), 64.2, 50.8, 49.7, 48.6, 45.6, 27.3, 25.9, 17.3, 13.9 ppm.

^{19}F NMR (376 MHz, Chloroform-*d*) $\delta = -112.83$ (s, 1F) ppm.

HRMS (ESI) m/z calculated for $C_{17}H_{22}FNONa^+$ $[M+Na]^+$: 298.1578, found: 298.1581.

HPLC-Data: 98% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_R = 10.6$ (minor), 11.1 (major).

(S)-1-(5-(3-Chlorophenyl)-4,4-dimethyl-3,4-dihydro-2H-pyrrol-2-yl)pentan-2-one
(3aq)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a yellow oil (40.9 mg, 70% yield).

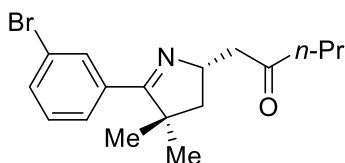
¹H NMR (400 MHz, Chloroform-*d*) δ = 7.66 (s, 1H), 7.53 (d, J = 7.7 Hz, 1H), 7.36 (d, J = 8.3 Hz, 1H), 7.29 (t, J = 7.8 Hz, 1H), 4.46 – 4.36 (m, 1H), 3.08 (dd, J = 16.5, 5.5 Hz, 1H), 2.53 (dd, J = 16.6, 8.5 Hz, 1H), 2.52 – 2.41 (m, 2H), 2.23 (dd, J = 12.6, 6.8 Hz, 1H), 1.68 – 1.58 (m, 2H), 1.49 (dd, J = 12.6, 8.9 Hz, 1H), 1.33 (s, 3H), 1.31 (s, 3H), 0.93 (t, J = 7.4 Hz, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 209.8, 178.9, 136.5, 134.3, 129.7, 129.6, 128.2, 126.0, 64.2, 50.8, 49.6, 48.5, 45.6, 27.3, 25.9, 17.3, 13.9 ppm.

HRMS (ESI) m/z calculated for C₁₇H₂₂ClNOH⁺ [M+H]⁺: 292.1463, found: 292.1467.

HPLC-Data: 97% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): t_R = 10.6 (major), 12.0 (minor).

(*S*)-1-(5-(3-Bromophenyl)-4,4-dimethyl-3,4-dihydro-2*H*-pyrrol-2-yl)pentan-2-one
(3ar)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a yellow oil (44.5 mg, 66% yield).

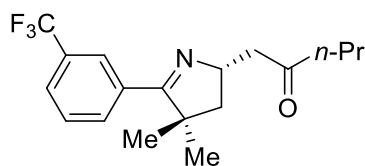
¹H NMR (400 MHz, Chloroform-*d*) δ = 7.82 (s, 1H), 7.57 (d, J = 7.8 Hz, 1H), 7.51 (d, J = 8.1 Hz, 1H), 7.23 (t, J = 7.9 Hz, 1H), 4.46 – 4.36 (m, 1H), 3.09 (dd, J = 16.6, 5.5 Hz, 1H), 2.53 (dd, J = 16.6, 8.5 Hz, 1H), 2.52 – 2.39 (m, 2H), 2.23 (dd, J = 12.6, 6.8 Hz, 1H), 1.68 – 1.58 (m, 2H), 1.49 (dd, J = 12.6, 8.8 Hz, 1H), 1.33 (s, 3H), 1.31 (s, 3H), 0.93 (t, J = 7.4 Hz, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 209.8, 178.8, 136.7, 132.6, 131.1, 129.8, 126.4, 122.5, 64.2, 50.8, 49.6, 48.5, 45.6, 27.3, 25.8, 17.3, 13.9 ppm.

HRMS (ESI) m/z calculated for C₁₇H₂₂BrNOH⁺ [M+H]⁺: 336.0958, found: 336.0962.

HPLC-Data: 96% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): t_R = 8.8 (major), 10.0 (minor).

(S)-1-(4,4-Dimethyl-5-(3-(trifluoromethyl)phenyl)-3,4-dihydro-2H-pyrrol-2-yl)-pentan-2-one (3as)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a yellow oil (43.4 mg, 67% yield).

$^1\text{H NMR}$ (400 MHz, Chloroform-*d*) δ = 7.95 (s, 1H), 7.85 (d, J = 7.8 Hz, 1H), 7.64 (d, J = 7.8 Hz, 1H), 7.49 (t, J = 7.8 Hz, 1H), 4.48 – 4.39 (m, 1H), 3.10 (dd, J = 16.5, 5.6 Hz, 1H), 2.55 (dd, J = 16.5, 8.3 Hz, 1H), 2.51 – 2.40 (m, 2H), 2.26 (dd, J = 12.6, 6.8 Hz, 1H), 1.69 – 1.59 (m, 2H), 1.52 (dd, J = 12.7, 8.8 Hz, 1H), 1.35 (s, 3H), 1.33 (s, 3H), 0.93 (t, J = 7.4 Hz, 3H) ppm.

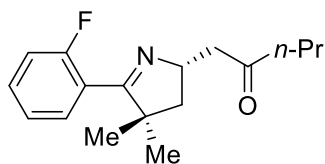
$^{13}\text{C NMR}$ (101 MHz, Chloroform-*d*) δ = 209.8, 178.7, 135.5, 131.1, 130.8 (q, J = 32.5 Hz), 128.8, 126.3 (q, J = 3.7 Hz), 124.1 (q, J = 273.2 Hz), 124.9 (q, J = 3.8 Hz), 64.4, 50.8, 49.6, 48.6, 45.6, 27.3, 25.8, 17.3, 13.8 ppm.

$^{19}\text{F NMR}$ (376 MHz, Chloroform-*d*) δ = -62.71 (s, 3F) ppm.

HRMS (ESI) m/z calculated for $\text{C}_{18}\text{H}_{22}\text{F}_3\text{NOH}^+$ $[\text{M}+\text{H}]^+$: 326.1726, found: 326.1727.

HPLC-Data: 98% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): t_{R} = 7.8 (major), 8.4 (minor).

(S)-1-(5-(2-Fluorophenyl)-4,4-dimethyl-3,4-dihydro-2H-pyrrol-2-yl)pentan-2-one (3at)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (33.5 mg, 61% yield).

$^1\text{H NMR}$ (400 MHz, Chloroform-*d*) δ = 7.38 – 7.31 (m, 1H), 7.25 (t, J = 7.4 Hz, 1H), 7.14 (t, J = 7.5 Hz, 1H), 7.09 (t, J = 9.1 Hz, 1H), 4.55 – 4.45 (m, 1H), 3.13 (dd, J = 16.7, 5.3 Hz, 1H), 2.59 (dd, J = 16.7, 8.6 Hz, 1H), 2.52 – 2.40 (m, 2H), 2.26 (dd, J =

12.6, 6.9 Hz, 1H), 1.68 – 1.58 (m, 2H), 1.51 (dd, $J = 12.7, 8.6$ Hz, 1H), 1.19 (s, 3H), 1.16 (s, 3H), 0.92 (t, $J = 7.4$ Hz, 3H) ppm.

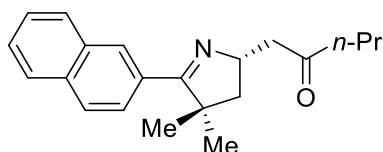
^{13}C NMR (101 MHz, Chloroform- d) $\delta = 209.8, 178.9, 159.8$ (d, $J = 247.8$ Hz), 130.6 (d, $J = 8.1$ Hz), 130.3 (d, $J = 3.6$ Hz), 123.9 (d, $J = 3.6$ Hz), 123.4 (d, $J = 17.0$ Hz), 116.0 (d, $J = 22.3$ Hz), 65.4, 52.3, 49.6, 46.6, 45.6, 26.4 (d, $J = 2.6$ Hz), 25.0 (d, $J = 2.7$ Hz), 17.3, 13.9 ppm.

^{19}F NMR (376 MHz, Chloroform- d) $\delta = -112.49$ (s, 1F) ppm.

HRMS (ESI) m/z calculated for $\text{C}_{17}\text{H}_{22}\text{FNOH}^+$ $[\text{M}+\text{H}]^+$: 276.1758, found: 276.1765.

HPLC-Data: 95% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_{\text{R}} = 14.1$ (minor), 15.2 (major).

(*S*)-1-(4,4-Dimethyl-5-(naphthalen-2-yl)-3,4-dihydro-2*H*-pyrrol-2-yl)pentan-2-one (3au)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 5:1) as a colorless oil (28.9 mg, 47% yield).

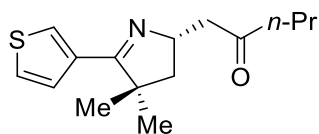
^1H NMR (400 MHz, Chloroform- d) $\delta = 8.15$ (s, 1H), 7.90 – 7.80 (m, 4H), 7.54 – 7.46 (m, 2H), 4.52 – 4.42 (m, 1H), 3.17 (dd, $J = 16.4, 5.4$ Hz, 1H), 2.59 (dd, $J = 16.5, 8.7$ Hz, 1H), 2.55 – 2.43 (m, 2H), 2.29 (dd, $J = 12.6, 6.7$ Hz, 1H), 1.71 – 1.61 (m, 2H), 1.56 (dd, $J = 12.6, 8.8$ Hz, 1H), 1.45 (s, 3H), 1.43 (s, 3H), 0.95 (t, $J = 7.4$ Hz, 3H) ppm.

^{13}C NMR (101 MHz, Chloroform- d) $\delta = 210.1, 179.8, 133.9, 132.9, 132.1, 128.8, 128.0, 127.8, 127.7, 127.0, 126.4, 125.7, 64.3, 50.9, 49.9, 48.9, 45.7, 27.7, 26.2, 17.4, 13.9$ ppm.

HRMS (ESI) m/z calculated for $\text{C}_{21}\text{H}_{25}\text{NOH}^+$ $[\text{M}+\text{H}]^+$: 308.2009, found: 308.2013.

HPLC-Data: 98% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_{\text{R}} = 15.8$ (major), 20.6 (minor).

(S)-1-(4,4-Dimethyl-5-(thiophen-3-yl)-3,4-dihydro-2H-pyrrol-2-yl)pentan-2-one
(3av)



The title compound was isolated through column chromatography (silica gel, petroleum ether/ethyl acetate = 4:1) as a yellow oil (22.3 mg, 42% yield).

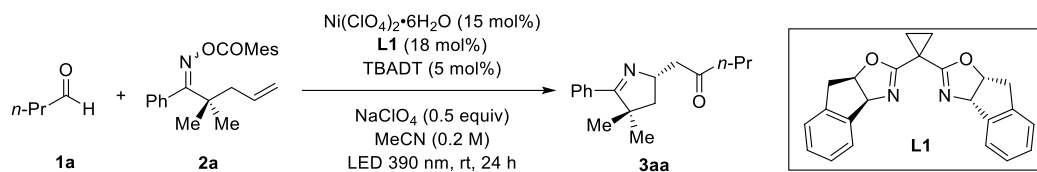
¹H NMR (400 MHz, Chloroform-*d*) δ = 7.71 (s, 1H), 7.51 (d, J = 5.1 Hz, 1H), 7.32 – 7.28 (m, 1H), 4.43 – 4.34 (m, 1H), 3.09 (dd, J = 16.3, 5.4 Hz, 1H), 2.52 (dd, J = 16.3, 8.7 Hz 1H), 2.51 – 2.40 (m, 2H), 2.23 (dd, J = 12.7, 7.0 Hz, 1H), 1.69 – 1.59 (m, 2H), 1.47 (dd, J = 12.7, 8.5 Hz, 1H), 1.40 (s, 3H), 1.34 (s, 3H), 0.93 (t, J = 7.4 Hz, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 210.1, 175.1, 135.9, 128.2, 126.1, 125.4, 64.4, 50.5, 50.0, 48.1, 45.6, 27.8, 26.1, 17.4, 13.9 ppm.

HRMS (ESI) m/z calculated for C₁₅H₂₁NOSNa⁺ [M+Na]⁺: 286.1236, found: 286.1245.

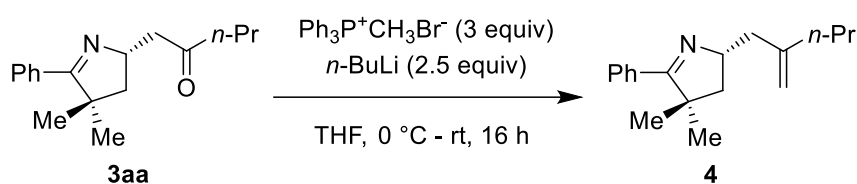
HPLC-Data: 90% *ee*, (Chiral AD-H column, λ = 254 nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): t_R = 18.3 (major), 21.8 (minor).

Synthesis of Compound **3aa** on a 2.0 mmol Scale



Tetrabutyl ammonium decatungstate (TBADT) (332.0 mg, 0.1 mmol, 5 mol%), $\text{Ni}(\text{ClO}_4)_2 \cdot 6\text{H}_2\text{O}$ (109.7 mg, 0.3 mmol, 15 mol%), the ligand **L1** (128.3 mg, 0.36 mmol, 18 mol%), NaClO_4 (122.4 mg, 1.0 mmol, 0.5 equiv), and the oxime ester **2a** (698.4 mg, 2.0 mmol, 1 equiv) were placed in an oven-dried Schlenk tube equipped with a magnetic stirring bar. The tube was evacuated and filled with nitrogen (three cycles). To these solids, dry MeCN (10 mL, 0.2 M) and butanal (**1a**, 0.55 mL, 6.0 mmol, 3 equiv) were sequentially added under nitrogen atmosphere. Subsequently, the reaction mixture was stirred and irradiated using two 34 W 390 nm LED lamps (Kessil PR160-390, 5 cm away, with adequate fans keep the reaction at room temperature) for 24 h. After exposing to air for 15 minutes, the reaction mixture was filtered through a pad of Celite and concentrated under reduced pressure. The residue was purified through column chromatography (silica gel, EtOAc/petroleum ether = 1:5) to afford the desired product **3aa** (329.0 mg, 1.28 mmol, 64% yield, 98% *ee*).

Derivatizations of the Imino-acylation Products **3aa** and **3ha**



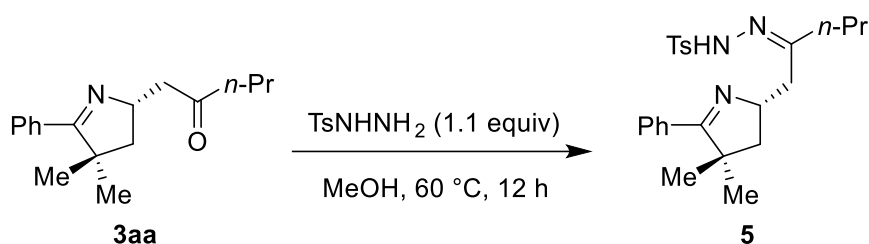
An oven-dried test tube was charged with methyl triphenylphosphonium bromide (107 mg, 0.3 mmol, 3 equiv), to which dry THF (1 mL) was added under N₂ atmosphere. The resulting suspension was cooled to 0 °C, and *n*-BuLi (0.1 mL, 0.25 mmol, 2.5 equiv, 2.5 M solution in hexane) was added. After the resulting yellow solution was stirred for 30 minutes, a solution of **3aa** (98% *ee*, 25.7 mg, 0.1 mmol, 1 equiv) in THF (0.5 mL) was added to the reaction mixture. The cooling bath was then removed, and the solution was stirred at room temperature. After 16 h, the reaction was quenched with sat. aq. NH₄Cl solution. The organic layer was separated, and the aqueous layer was extracted with Et₂O. The combined organic layers were concentrated under reduced pressure. The residue was purified through column chromatography on silica gel (EtOAc/petroleum ether = 1:9) to give (*R*)-4,4-dimethyl-2-(2-methylenepentyl)-5-phenyl-3,4-dihydro-2H-pyrrole (**4**) as a colorless oil in 61% yield (15.5 mg) and 98% *ee*.

¹H NMR (400 MHz, Chloroform-*d*) δ = 7.69 (d, *J* = 7.7 Hz, 2H), 7.41 – 7.34 (m, 3H), 4.82 (s, 2H), 4.22 – 4.13 (m, 1H), 2.81 (dd, *J* = 14.1, 5.0 Hz, 1H), 2.11 – 2.02 (m, 4H), 1.57 (dd, *J* = 12.6, 8.5 Hz 1H), 1.56 – 1.47 (m, 2H), 1.35 (s, 6H), 0.93 (t, *J* = 7.3 Hz, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 179.3, 147.5, 135.1, 129.5, 128.3 (2C), 128.0 (2C), 111.0, 66.8, 50.5, 48.0, 43.6, 38.6, 27.6, 26.3, 21.0, 14.0 ppm.

HRMS (ESI) *m/z* calculated for C₁₈H₂₅NH⁺ [M+H]⁺: 256.2060, found: 256.2072.

HPLC-Data: 98% *ee*, (Chiral AD-H column, λ = 254 nm, hexane/isopropanol = 98/2, flow rate = 0.5 mL/min): t_R = 8.0 (major), 9.5 (minor).



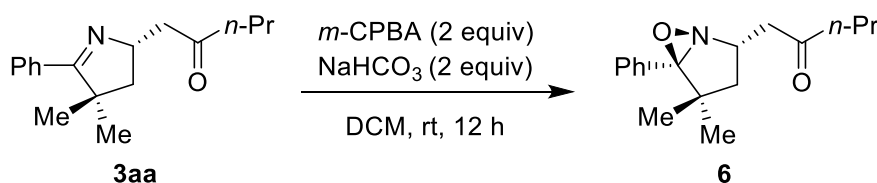
A solution of TsNHNH₂ (41.0 mg, 0.22 mmol, 1.1 equiv) in MeOH (1 mL) was stirred at 60 °C until TsNHNH₂ was completely dissolved. Subsequently, compound **3aa** (98% *ee*, 51.4 mg, 0.2 mmol, 1 equiv) was slowly added to the mixture. After stirring at 60 °C for 12 h, the reaction mixture was cooled to room temperature and quenched with H₂O. The organic layer was separated, and the aqueous layer was extracted with EtOAc. The combined organic layers were concentrated under reduced pressure. The residue was purified through column chromatography on silica gel (EtOAc/petroleum ether = 1:5) to give (*S,Z*)-*N'*-(1-(4,4-dimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrol-2-yl)pentan-2-ylidene)-4-methylbenzenesulfonamide (**5**) as a white solid in 53% yield (44.9 mg) and 96% *ee*.

¹H NMR (400 MHz, Chloroform-*d*) δ = 11.44 – 11.18 (brs, 1H), 7.83 (d, *J* = 6.4 Hz, 2H), 7.72 (d, *J* = 8.2 Hz, 2H), 7.52 – 7.43 (m, 3H), 7.14 (d, *J* = 8.0 Hz, 2H), 3.91 – 3.79 (m, 1H), 2.61 (dd, *J* = 13.3, 11.4 Hz, 1H), 2.33 (s, 3H), 2.28 – 2.20 (m, 3H), 2.06 (dd, *J* = 12.3, 6.1 Hz, 1H), 1.60 (dd, *J* = 12.5, 10.4 Hz, 1H), 1.58 – 1.49 (m, 2H), 1.37 (s, 3H), 1.34 (s, 3H), 0.83 (t, *J* = 7.4 Hz, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 181.5, 160.1, 142.9, 136.6, 133.2, 130.6, 129.2 (2C), 128.5 (2C), 128.2 (2C), 128.0 (2C), 66.5, 50.1, 49.3, 40.5, 37.6, 26.9, 24.9, 21.6, 19.4, 13.8 ppm.

HRMS (ESI) *m/z* calculated for C₂₄H₃₁N₃O₂SH⁺ [M+H]⁺: 426.2210, found: 426.2211.

HPLC-Data: 96% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): *t*_R = 17.5 (minor), 26.4 (major).



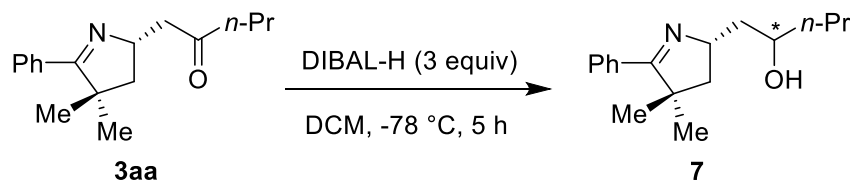
A solution of **3aa** (98% *ee*, 25.7 mg, 0.1 mmol, 1 equiv), *m*-CPBA (34.5 mg, 0.2 mmol, 2 equiv) and NaHCO₃ (16.8 mg, 0.2 mmol, 2equiv) in DCM (1 mL) were stirred at room temperature for 12 h. The resulting mixture was concentrated under reduced pressure. The residue was purified through column chromatography on silica gel (EtOAc/petroleum ether = 1:6) to give *1-((2S,5S)-4,4-dimethyl-5-phenyl-6-oxa-1-azabicyclo[3.1.0]hexan-2-yl)pentan-2-one* (**6**) as a colorless oil in 68% yield (18.6 mg, >98:2 dr) and 98% *ee*.

¹H NMR (400 MHz, Chloroform-*d*) δ = 7.41 – 7.31 (m, 5H), 3.98 – 3.88 (m, 1H), 3.10 (dd, *J* = 17.1, 5.7 Hz, 1H), 2.61 (dd, *J* = 17.1, 7.5 Hz, 1H), 2.52 – 2.41 (m, 2H), 1.79 (dd, *J* = 12.3, 6.9 Hz, 1H), 1.67 – 1.58 (m, 2H), 1.32 (dd, *J* = 12.4, 9.9 Hz, 1H), 1.26 (s, 3H), 1.02 (s, 3H), 0.92 (t, *J* = 7.4 Hz, 3H) ppm.

¹³C NMR (101 MHz, Chloroform-*d*) δ = 209.3, 133.7, 128.8, 128.0 (2C), 127.6 (2C), 94.2, 60.9, 45.8, 45.6, 42.6, 41.3, 24.4, 22.7, 17.3, 13.8 ppm.

HRMS (ESI) *m/z* calculated for C₁₇H₂₃NO₂H⁺ [M+H]⁺: 274.1802, found: 274.1811.

HPLC-Data: 98% *ee*, (Chiral MD column, λ = 190 nm, hexane/isopropanol = 90/10, flow rate = 0.5 mL/min): t_R = 23.0 (minor), 30.1 (major).



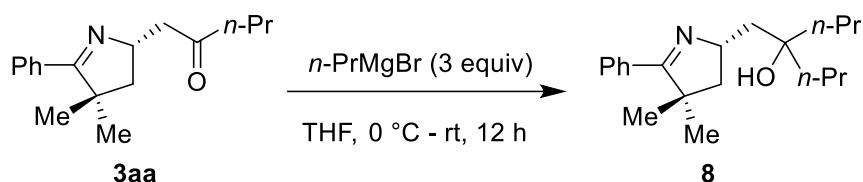
An oven-dried test tube was charged with **3aa** (98% *ee*, 25.7 mg, 0.1 mmol, 1 equiv), to which dry DCM (1 mL) was added under N₂ atmosphere. DIBAL-H (0.3 mL, 0.3 mmol, 3 equiv, 1.0 M solution in hexane) was added dropwise to the reaction mixture at -78 °C. After stirring for 5 h, the reaction was quenched with 1N HCl. The organic layer was separated and the aqueous layer was extracted with DCM. The combined organic layers were concentrated under reduced pressure. The residue was purified through column chromatography on silica gel (EtOAc/petroleum ether = 1:3) to give *1-((S)-4,4-dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)pentan-2-ol* (**7**) as a colorless oil in 54% yield (14.1 mg, >98:2 dr) and 98% *ee*.

¹H NMR (500 MHz, Chloroform-*d*) δ = 7.71 (d, J = 7.9 Hz, 2H), 7.44 – 7.33 (m, 3H), 4.50 – 4.07 (brs, 1H), 4.32 – 4.23 (m, 1H), 3.98 – 3.90 (m, 1H), 2.09 (dd, J = 12.4, 6.6 Hz, 1H), 1.95 – 1.88 (m, 1H), 1.80 – 1.73 (m, 1H), 1.71 – 1.64 (m, 1H), 1.60 (dd, J = 12.4, 9.4 Hz, 1H), 1.56 – 1.49 (m, 2H), 1.39 (s, 3H), 1.36 (s, 3H), 1.29 – 1.24 (m, 1H), 0.96 (t, J = 7.1 Hz, 3H) ppm.

¹³C NMR (126 MHz, Chloroform-*d*) δ = 179.6, 134.2, 129.9, 128.4 (2C), 128.0 (2C), 70.2, 64.6, 49.7, 49.1, 42.2, 39.3, 27.3, 25.8, 19.5, 14.4 ppm.

HRMS (ESI) m/z calculated for C₁₇H₂₅NOH⁺ [M+H]⁺: 260.2009, found: 260.2009.

HPLC-Data: 98% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): t_R = 10.0 (minor), 11.3 (major).



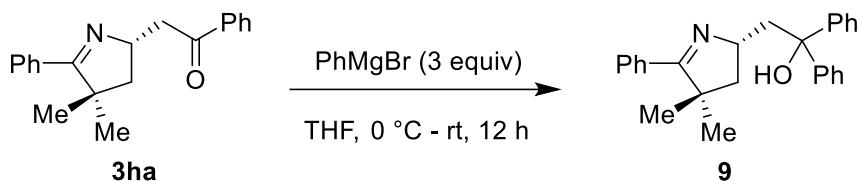
An oven-dried test tube was charged with **3aa** (98% *ee*, 25.7 mg, 0.1 mmol, 1 equiv), to which dry THF (1 mL) was added under N₂ atmosphere. *n*-PrMgBr (0.3 mL, 0.3 mmol, 3 equiv, 1.0 M solution in THF) was added dropwise to the reaction mixture at 0 °C. After the resulting yellow solution was stirred for 10 min, the cooling bath was then removed, and the reaction mixture was stirred at room temperature. After 12 h, the reaction was quenched with sat. aq. NH₄Cl solution. The organic layer was separated, and the aqueous layer was extracted with Et₂O. The combined organic layers were concentrated under reduced pressure. The residue was purified through column chromatography on silica gel (EtOAc/petroleum ether = 1:9) to give (*S*)-4-((4,4-dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)methyl)heptan-4-ol (**8**) as a colorless oil in 88% yield (26.5 mg) and 96% *ee*.

¹H NMR (400 MHz, Chloroform-*d*) δ = 7.73 (d, J = 7.9 Hz, 2H), 7.44 – 7.31 (m, 3H), 6.20 – 5.46 (brs, 1H), 4.30 – 4.19 (m, 1H), 2.10 (dd, J = 12.4, 6.5 Hz, 1H), 1.88 (dd, J = 14.1, 3.7 Hz, 1H), 1.77 – 1.61 (m, 2H), 1.59 – 1.49 (m, 2H), 1.42 (s, 3H), 1.48 – 1.24 (m, 6H), 1.36 (s, 3H), 0.95 (t, J = 7.4 Hz, 3H), 0.91 (t, J = 7.4 Hz, 3H) ppm.

^{13}C NMR (101 MHz, Chloroform-*d*) δ = 178.8, 133.8, 130.1, 128.3 (2C), 128.1 (2C), 74.4, 64.3, 49.9, 49.1, 45.8, 42.8, 41.1, 27.3, 26.0, 17.9, 16.7, 15.02, 14.96 ppm.

HRMS (ESI) m/z calculated for $\text{C}_{20}\text{H}_{31}\text{NOH}^+$ $[\text{M}+\text{H}]^+$: 302.2478, found: 302.2080.

HPLC-Data: 96% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): t_{R} = 8.0 (minor), 15.8 (major).



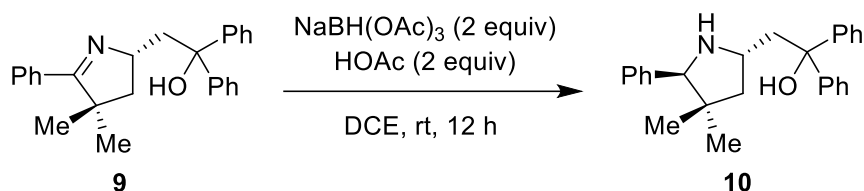
An oven-dried test tube was charged with **3ha** (92% *ee*, 145.5 mg, 0.5 mmol, 1 equiv), to which dry THF (2 mL) was added under N_2 atmosphere. PhMgBr (1.5 mL, 1.5 mmol, 3 equiv, 1.0 M solution in THF) was added dropwise to the reaction mixture at 0 °C. After the resulting yellow solution was stirred for 10 min, the cooling bath was removed, and the reaction mixture was stirred at room temperature for 12 h. Subsequently, the reaction was quenched with sat. aq. NH_4Cl solution. The organic layer was separated, and the aqueous layer was extracted with Et_2O . The combined organic layers were concentrated under reduced pressure. The residue was purified through column chromatography on silica gel (EtOAc /petroleum ether = 1:9) to give (*S*)-2-(4,4-dimethyl-5-phenyl-3,4-dihydro-2H-pyrrol-2-yl)-1,1-diphenylethan-1-ol (**9**) as a white solid in 60% yield (110.8 mg) and 90% *ee*.

^1H NMR (500 MHz, Chloroform-*d*) δ = 7.79 (d, J = 8.5 Hz, 2H), 7.76 – 7.57 (brs, 1H), 7.64 (d, J = 8.2 Hz, 2H), 7.54 (d, J = 8.3 Hz, 2H), 7.44 – 7.30 (m, 7H), 7.26 – 7.18 (m, 2H), 4.04 – 3.95 (m, 1H), 2.90 (dd, J = 14.0, 3.0 Hz, 1H), 2.23 (dd, J = 14.0, 11.7 Hz, 1H), 2.11 (dd, J = 12.4, 6.6 Hz, 1H), 1.65 (dd, J = 12.4, 9.2 Hz, 1H), 1.38 (s, 3H), 1.32 (s, 3H) ppm.

^{13}C NMR (126 MHz, Chloroform-*d*) δ = 178.7, 148.7, 147.5, 133.6, 130.2, 128.4 (2C), 128.18 (4C), 128.16 (2C), 126.6, 126.5 (2C), 126.4, 125.8 (2C), 78.5, 64.9, 49.4, 49.0, 47.7, 27.3, 25.9 ppm.

HRMS (ESI) m/z calculated for $\text{C}_{26}\text{H}_{27}\text{NOH}^+$ $[\text{M}+\text{H}]^+$: 370.2165, found: 370.2170.

HPLC-Data: 90% *ee*, (Chiral MD column, $\lambda = 254$ nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): $t_R = 11.0$ (minor), 14.0 (major).



A solution of **9** (90% *ee*, 110.8 mg, 0.3 mmol, 1 equiv), NaBH(OAc)_3 (127.1 mg, 0.6 mmol, 2 equiv) and HOAc (35 μL , 0.6 mmol, 2 equiv) in 1,2-DCE (1.5 mL) were stirred at room temperature for 12 h. Next, the mixture was concentrated under reduced pressure and the residue was purified through column chromatography on silica gel (EtOAc/petroleum ether = 1:2) to give 2-((2*S*,5*S*)-4,4-dimethyl-5-phenylpyrrolidin-2-yl)-1,1-diphenylethan-1-ol (**10**) as a white solid in 75% yield (83.0 mg, 10:1 dr) and 92% *ee*.

$^1\text{H NMR}$ (500 MHz, Chloroform-*d*) δ (mixture of two diastereomers) = 7.56 (d, $J = 8.4$ Hz, 2H), [7.48 (d, $J = 7.9$ Hz, 0.18H)], 7.44 (d, $J = 8.2$ Hz, 1.82H), 7.38 – 7.23 (m, 8H), 7.21 – 7.07 (m, 3H), 3.84 (s, 0.91H), [3.81 (s, 0.09H)], 3.53 – 3.44 (m, 0.91H), [3.44 – 3.39 (m, 0.09H)], [2.74 (dd, $J = 14.2, 4.2$ Hz, 0.09H)], 2.56 (dd, $J = 14.3, 3.1$ Hz, 0.91H), [2.46 (dd, $J = 14.2, 11.0$ Hz, 0.09H)], 2.24 (dd, $J = 14.3, 11.6$ Hz, 0.91H), 2.00 (dd, $J = 12.8, 8.0$ Hz, 1H), [1.57 (dd, $J = 12.8, 4.6$ Hz, 0.09H)], 1.49 (dd, $J = 12.9, 7.4$ Hz, 0.91H), 1.05 (s, 2.73H), [0.99 (s, 0.27H)], [0.77 (s, 0.27H)], 0.53 (s, 2.73H) ppm (peaks in brackets are for the minor diastereomer).

$^{13}\text{C NMR}$ (126 MHz, Chloroform-*d*) δ (mixture of two diastereomers) = 149.0, [148.4], 147.6, [147.1], [139.8], 137.4, [128.4], 128.3 (2C), [128.2], 128.13 (2C), 128.11 (2C), [128.05 (2C)], [127.7], 127.4, [127.3], 127.1 (2C), [126.7], 126.55, 126.48 (2C), 126.35, [126.27], [125.7], [125.61], 125.60 (2C), [78.7], 78.2, [72.6], 70.1, 52.7, [52.3], 49.4, [47.5], [46.8], 46.2, 43.2, [41.6], [27.6], 26.2, [24.2], 22.3 ppm (peaks in brackets are for the minor diastereomer).

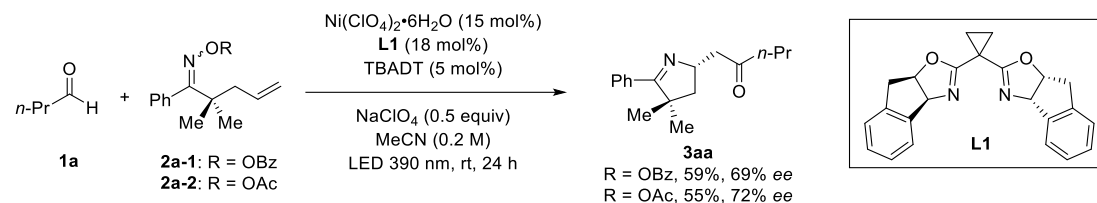
HRMS (ESI) m/z calculated for $\text{C}_{26}\text{H}_{29}\text{NOH}^+$ $[\text{M}+\text{H}]^+$: 372.2322, found: 372.2333.

HPLC-Data: 92% *ee*, (Chiralpak AD-H column, $\lambda = 254$ nm, hexane/isopropanol =

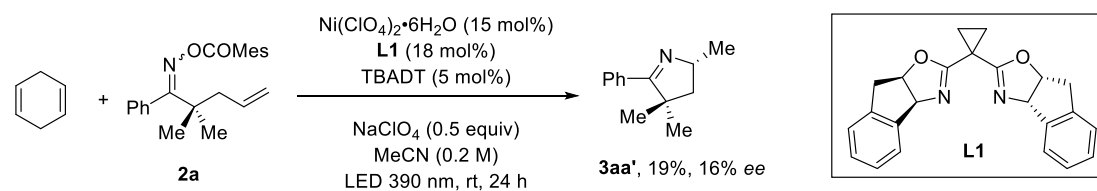
65/35, flow rate = 0.5 mL/min): $t_R = 8.0$ (minor enantiomer, major diastereomer), 9.6 (major enantiomer, minor diastereomer), 10.7 (major enantiomer, major diastereomer), 11.5 (minor enantiomer, minor diastereomer).

Mechanistic Studies

Control Experiments



Tetrabutyl ammonium decatungstate (TBADT) (33.2 mg, 0.01 mmol, 5 mol%), Ni(ClO₄)₂·6H₂O (11.0 mg, 0.03 mmol, 15 mol%), the ligand **L1** (12.8 mg, 0.036 mmol, 18 mol%), NaClO₄ (12.2 mg, 0.1 mmol, 0.5 equiv), and the oxime ester **2a-1** or **2a-2** (0.2 mmol, 1 equiv) were placed in an oven-dried test tube equipped with a magnetic stirring bar. The tube was evacuated and filled with nitrogen (three cycles). To these solids, dry MeCN (1 mL, 0.2 M) and butanal (**1a**, 55 μ L, 0.6 mmol, 3 equiv) were sequentially added under nitrogen atmosphere. Subsequently, the reaction mixture was stirred and irradiated using two 34 W 390 nm LED lamps (Kessil PR160-390, 5 cm away, with adequate fans keep the reaction at room temperature) for 24 h. After exposing to air for 15 minutes, the reaction mixture was filtered through a pad of Celite and concentrated under reduced pressure. The residue was purified through column chromatography on silica gel (EtOAc/petroleum ether = 1:5) to afford the desired product **3aa** (59% yield and 69% *ee* from **2a-1**, 55% yield and 72% *ee* from **2a-2**).



Tetrabutyl ammonium decatungstate (TBADT) (33.2 mg, 0.01 mmol, 5 mol%), Ni(ClO₄)₂·6H₂O (11.0 mg, 0.03 mmol, 15 mol%), ligand **L1** (12.8 mg, 0.036 mmol, 18 mol%), NaClO₄ (12.2 mg, 0.1 mmol, 0.5 equiv), and the oxime ester **2a** (51.4 mg, 0.2 mmol, 1 equiv) were placed in an oven-dried test tube equipped with a magnetic stir bar. The tube was evacuated and filled with nitrogen (three cycles). To these solids, dry MeCN (1 mL, 0.2 M) and cyclohexa-1,4-diene (57 μ L, 0.6 mmol, 3 equiv) were added

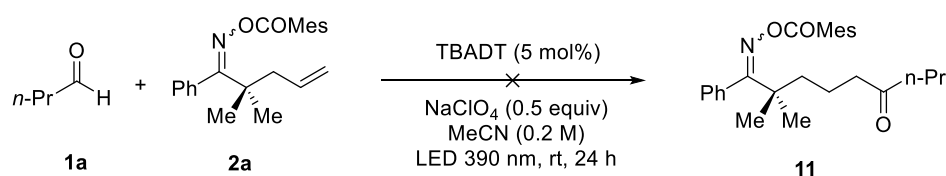
under nitrogen atmosphere, successively. Subsequently, the reaction mixture was stirred and irradiated using two 34 W 390 nm LED lamps (Kessil PR160-390, 5 cm away, with adequate fans and a water bath to keep the reaction at room temperature) for 24h. After exposing to air for 15 minutes, the reaction mixture was filtered through a pad of Celite and concentrated under reduced pressure. The residue was purified through column chromatography on silica gel (petroleum ether/ethyl acetate 5:1) to afford (*R*)-2,4,4-Trimethyl-5-phenyl-3,4-dihydro-2*H*-pyrrole (**3aa'**) as a colorless oil in 19% yield (7.1 mg) and 16% *ee*.

¹H NMR (400 MHz, Chloroform-*d*) δ = 7.69 (d, *J* = 7.6 Hz, 2H), 7.41 – 7.33 (m, 3H), 4.14 – 4.05 (m, 1H), 2.11 (dd, *J* = 12.4, 6.7 Hz, 1H), 1.51 (dd, *J* = 12.4, 8.6 Hz, 1H), 1.39 (d, *J* = 6.8 Hz, 3H), 1.35 (s, 3H), 1.33 (s, 3H) ppm.

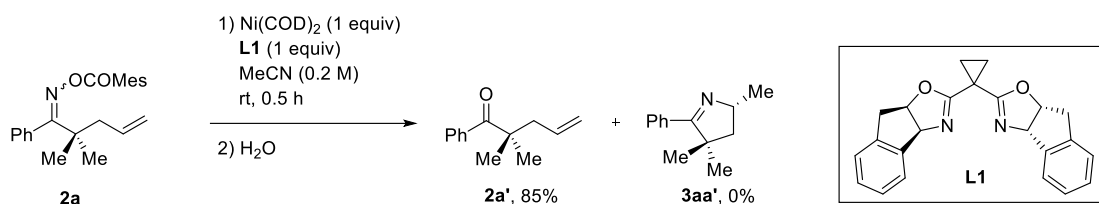
¹³C NMR (101 MHz, Chloroform-*d*) δ = 179.4, 134.9, 129.5, 128.3 (2C), 128.0 (2C), 63.3, 51.0, 50.0, 27.6, 26.0, 22.3 ppm.

HRMS (ESI) *m/z* calculated for C₁₃H₁₇NH⁺ [M+H]⁺: 188.1439, found: 188.1434.

HPLC-Data: 16% *ee*, (Chiral MD column, λ = 254 nm, hexane/isopropanol = 95/5, flow rate = 0.5 mL/min): *t*_R = 7.8 (minor), 8.5 (major).



Tetrabutyl ammonium decatungstate (TBADT) (33.2 mg, 0.01 mmol, 5 mol%), NaClO₄ (12.2 mg, 0.1 mmol, 0.5 equiv), and the oxime ester **2a** (51.4 mg, 0.2 mmol, 1 equiv) were placed in an oven-dried test tube equipped with a magnetic stir bar. The tube was evacuated and filled with nitrogen (three cycles). To these solids, dry MeCN (1 mL, 0.2 M) and butanal (**1a**, 55 μ L, 0.6 mmol, 3 equiv) were added under nitrogen atmosphere, successively. Subsequently, the reaction mixture was stirred and irradiated using two 34 W 390 nm LED lamps (Kessil PR160-390, 5 cm away, with adequate fans and a water bath to keep the reaction at room temperature) for 24h. After exposing to air for 15 minutes, the reaction mixture was filtered through a pad of Celite and concentrated under reduced pressure. According to TLC and NMR analysis, the product **11** was not observed.



$\text{Ni}(\text{COD})_2$ (27.5 mg, 0.1 mmol, 1.0 equiv), ligand **L1** (35.6 mg, 0.1 mmol, 1 equiv), and the oxime ester **2a** (25.7 mg, 0.1 mmol, 1.0 equiv) were placed in an oven-dried test tube equipped with a stir bar. The tube was evacuated and filled with nitrogen (three cycles). To these solids, dry MeCN (0.5 mL, 0.2 M) was added under nitrogen atmosphere. Subsequently, the reaction mixture was stirred for 30 min at room temperature, before it was quenched by water. The formation of **3aa'** was not observed. The reaction mixture was filtered through a pad of Celite and concentrated under reduced pressure. The residue was purified through column chromatography (silica gel, petroleum ether/ethyl acetate 20:1) to afford *2,2-dimethyl-1-phenylpent-4-en-1-one* (**2a'**) as a colorless oil in 85% yield (15.9 mg).

$^1\text{H NMR}$ (400 MHz, Chloroform-*d*) δ = 7.65 (d, J = 8.0 Hz, 2H), 7.45 (t, J = 7.3 Hz, 1H), 7.39 (t, J = 7.3 Hz, 2H), 5.79 – 5.66 (m, 1H), 5.07 – 4.97 (m, 2H), 2.49 (d, J = 7.3 Hz, 2H), 1.32 (s, 6H) ppm.

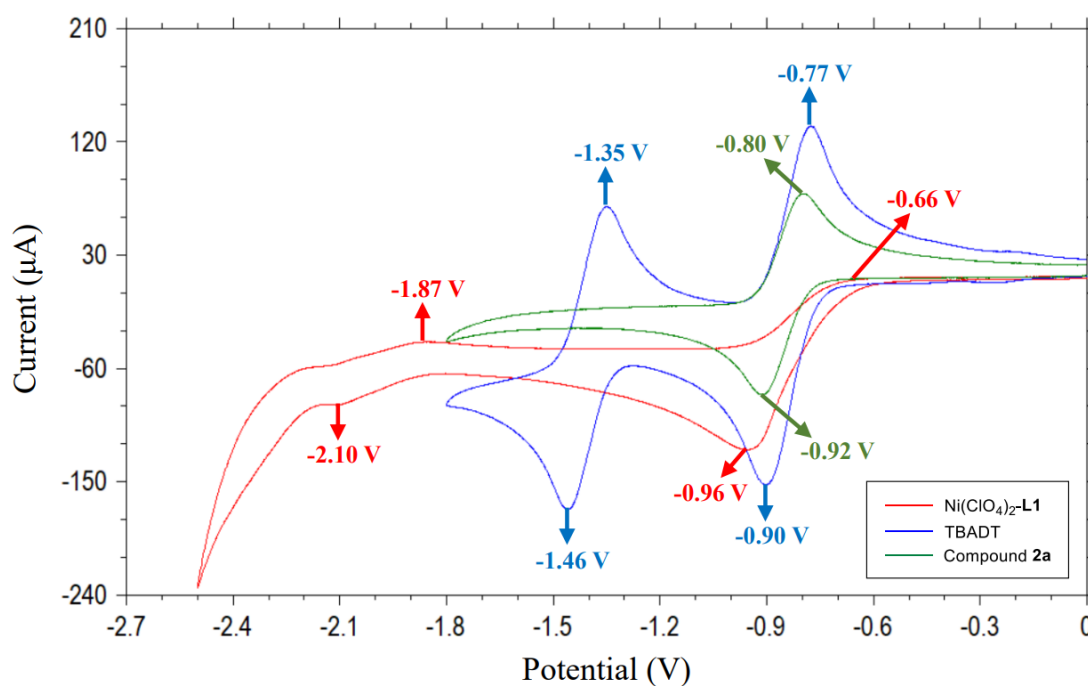
$^{13}\text{C NMR}$ (101 MHz, Chloroform-*d*) δ = 208.9, 139.2, 134.2, 130.9, 128.2 (2C), 127.7 (2C), 118.3, 47.8, 45.1, 25.9 (2C) ppm.

HRMS (ESI) m/z calculated for $\text{C}_{13}\text{H}_{16}\text{OH}^+$ $[\text{M}+\text{H}]^+$: 189.1274, found: 189.1275.

Cyclic Voltammetry Experiments

The following experiments were conducted on an electrochemical workstation CHI 760D. A glassy carbon working electrode (0.07 cm²) was employed alongside a platinum flag counter electrode and an Ag/AgCl (KCl sat.) reference electrode. The distance between the working and reference electrode was 1 cm. The polishing material is 50 nm α -aluminum oxide, and the solvent was degassed through purging with nitrogen atmosphere. The solution of TBADT (10 mM), compound **2a** (10 mM), or $[\text{Ni}(\text{ClO}_4)_2 \cdot 6\text{H}_2\text{O} + \text{L1}]$ (30 mM) [In a 15-mL vial equipped with a stirring bar, the ligand **L1** (53.5 mg, 0.15 mmol) and $\text{Ni}(\text{ClO}_4)_2 \cdot 6\text{H}_2\text{O}$ (54.9 mg, 0.15 mmol) were

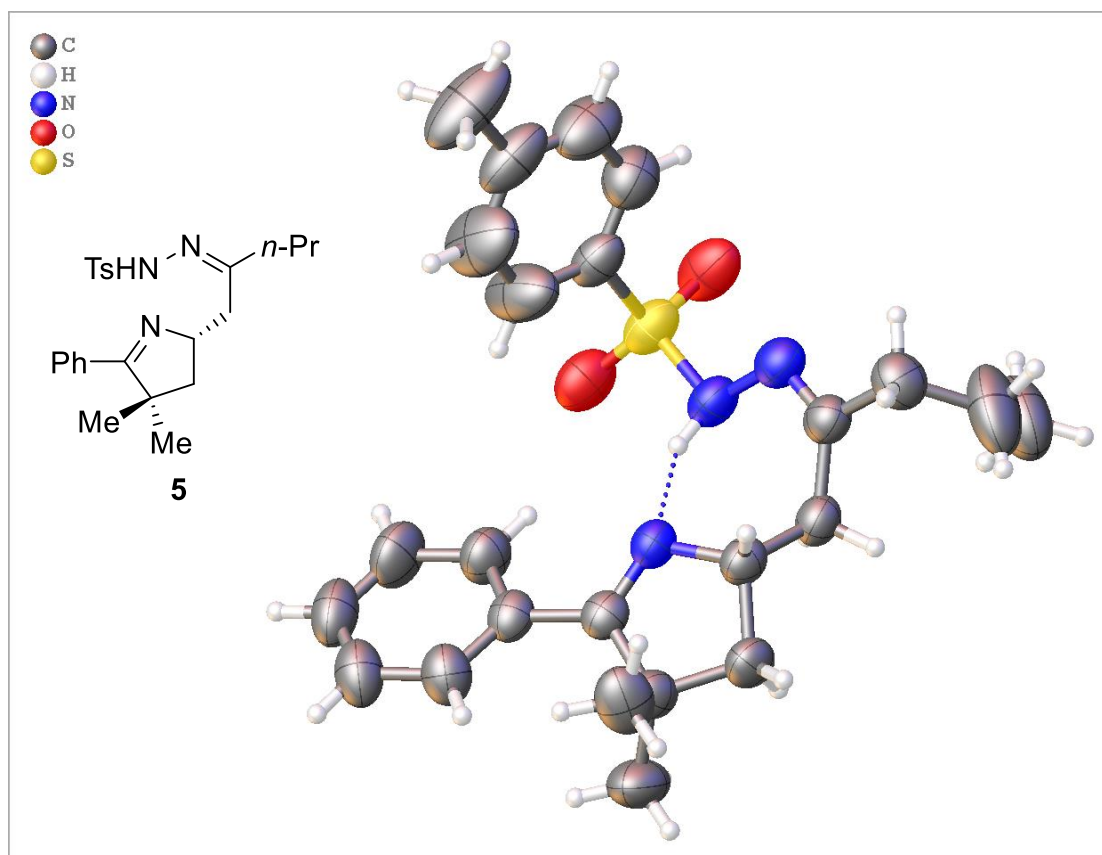
charged in a glovebox, before anhydrous MeCN (5 ml) was added. The mixture was stirred at room temperature for 0.5 h. The resulting solution was used in cyclic voltammogram studies without further purification.] in MeCN along with 0.1 M supporting electrolyte (tetrabutylammonium hexafluorophosphate) was tested at room temperature with the initial potential of 0 V and scan rate of 0.1 V/s (IUPAC, negative scan), respectively.



Cyclic voltammograms of $[\text{Ni}(\text{ClO}_4)_2 \cdot 6\text{H}_2\text{O} + \text{L1}]$ (Red), TBADT (Blue), and compound 2a (Green) in MeCN

Crystal Data and Structural Refinement

CCDC 2246373 contains the supplementary crystallographic data for the compound **5**. These data can be obtained free of charge from The Cambridge Crystallographic Data Centre.



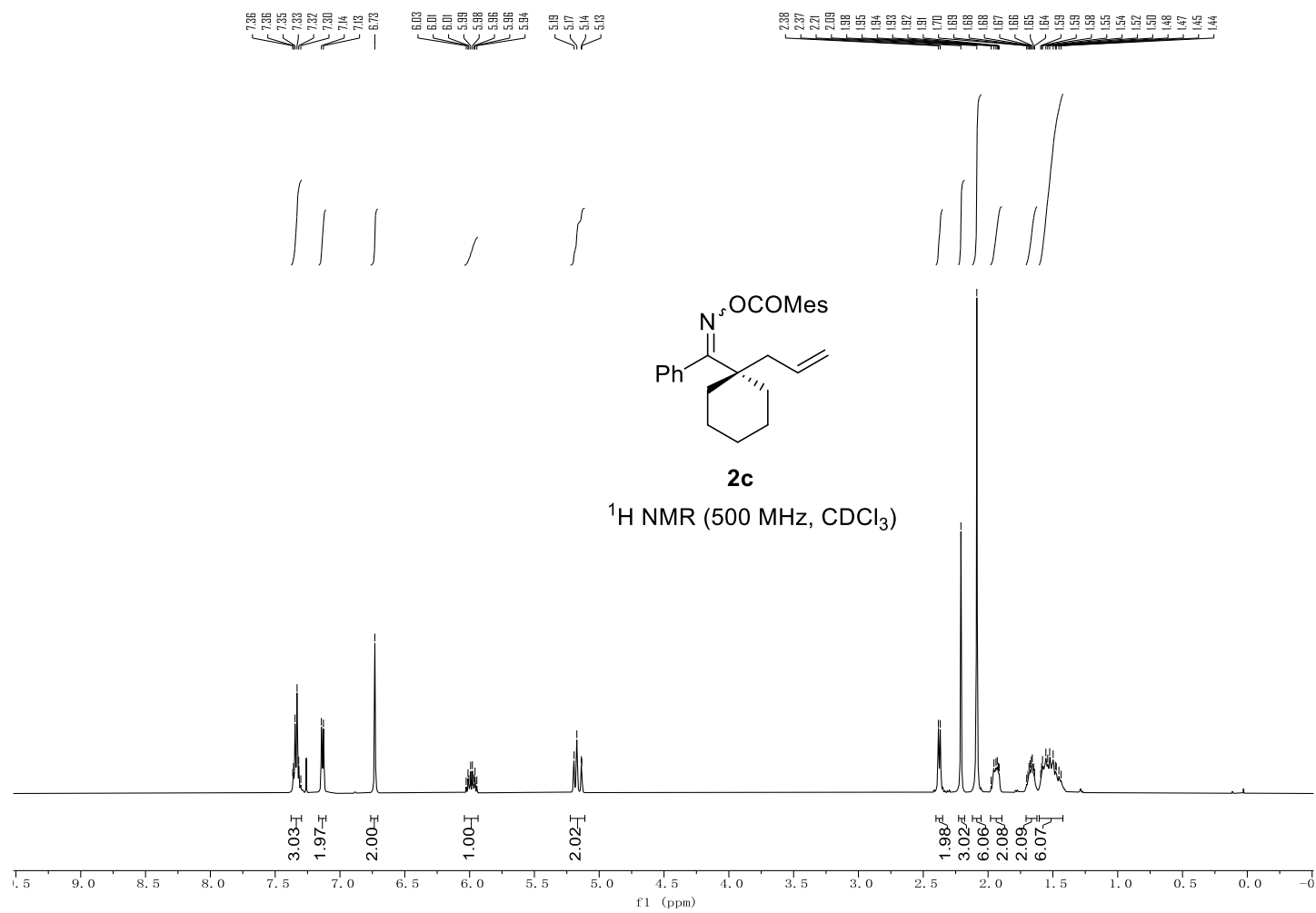
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Empirical formula	C ₂₄ H ₃₁ N ₃ O ₂ S
Formula weight	425.58
Temperature/K	293(2)
Crystal system	Orthorhombic
Space group	P2 ₁ 2 ₁ 2 ₁
a/Å	9.26014(12)
b/Å	11.7541(2)

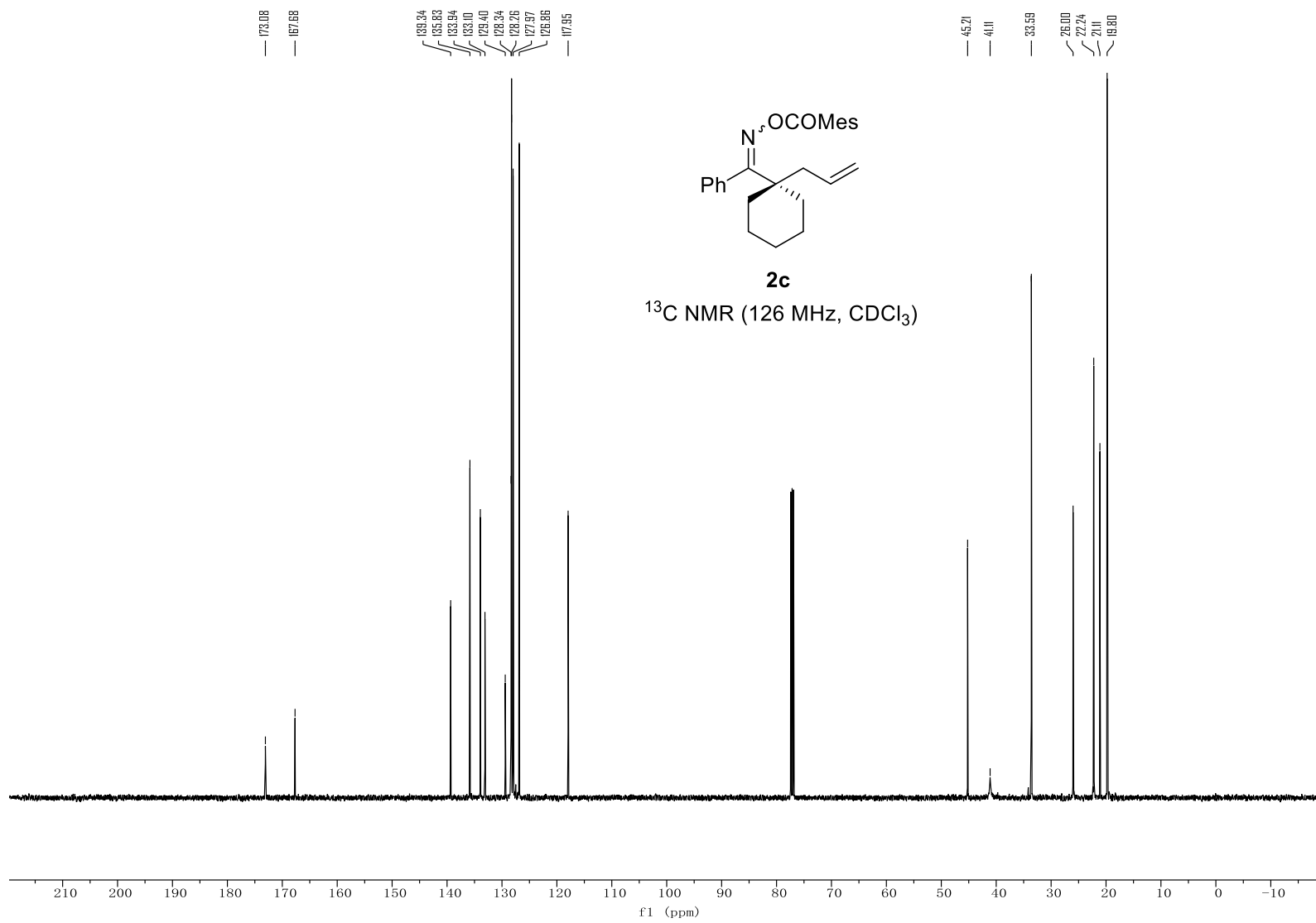
$c/\text{\AA}$	21.9162(3)
$\alpha/^\circ$	90
$\beta/^\circ$	90
$\gamma/^\circ$	90
Volume/ \AA^3	2385.46(6)
Z	4
$\rho_{\text{calc}}/\text{g/cm}^3$	1.185
μ/mm^{-1}	1.388
F(000)	912.0
Crystal size/ mm^3	$0.22 \times 0.17 \times 0.16$
Radiation	Cu K α ($\lambda = 1.54184$)
2Θ range for data collection/ $^\circ$	8.068 to 145.74
Index ranges	$-6 \leq h \leq 11, -11 \leq k \leq 14, -25 \leq l \leq 27$
Reflections collected	8750
Independent reflections	4615 [$R_{\text{int}} = 0.0181, R_{\text{sigma}} = 0.0256$]
Data/restraints/parameters	4615/0/280
Goodness-of-fit on F^2	1.021
Final R indexes [$I \geq 2\sigma(I)$]	$R_1 = 0.0408, wR_2 = 0.1181$
Final R indexes [all data]	$R_1 = 0.0430, wR_2 = 0.1214$
Largest diff. peak/hole / $e \text{\AA}^{-3}$	0.29/-0.26
Flack parameter	-0.008(9)

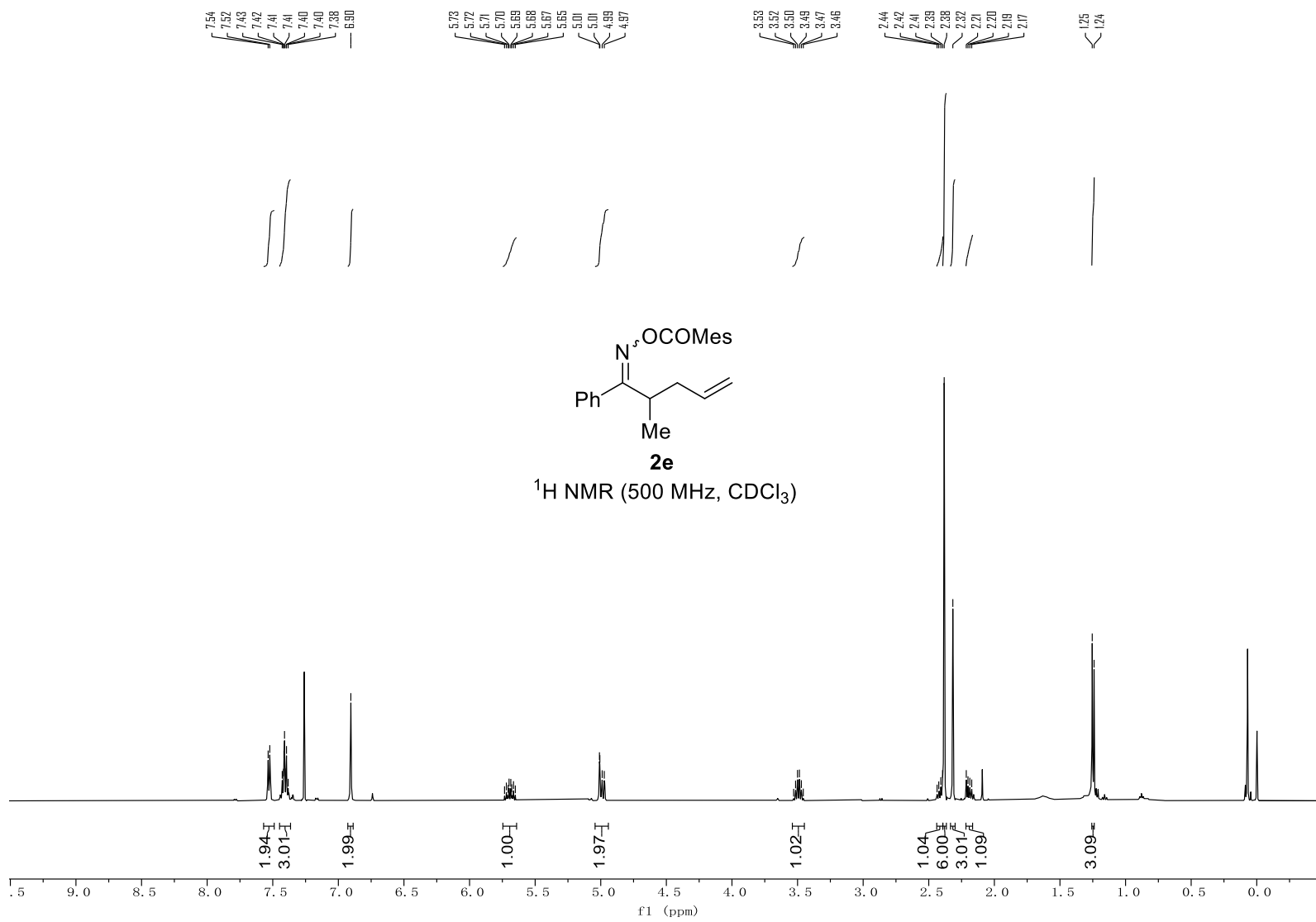
References

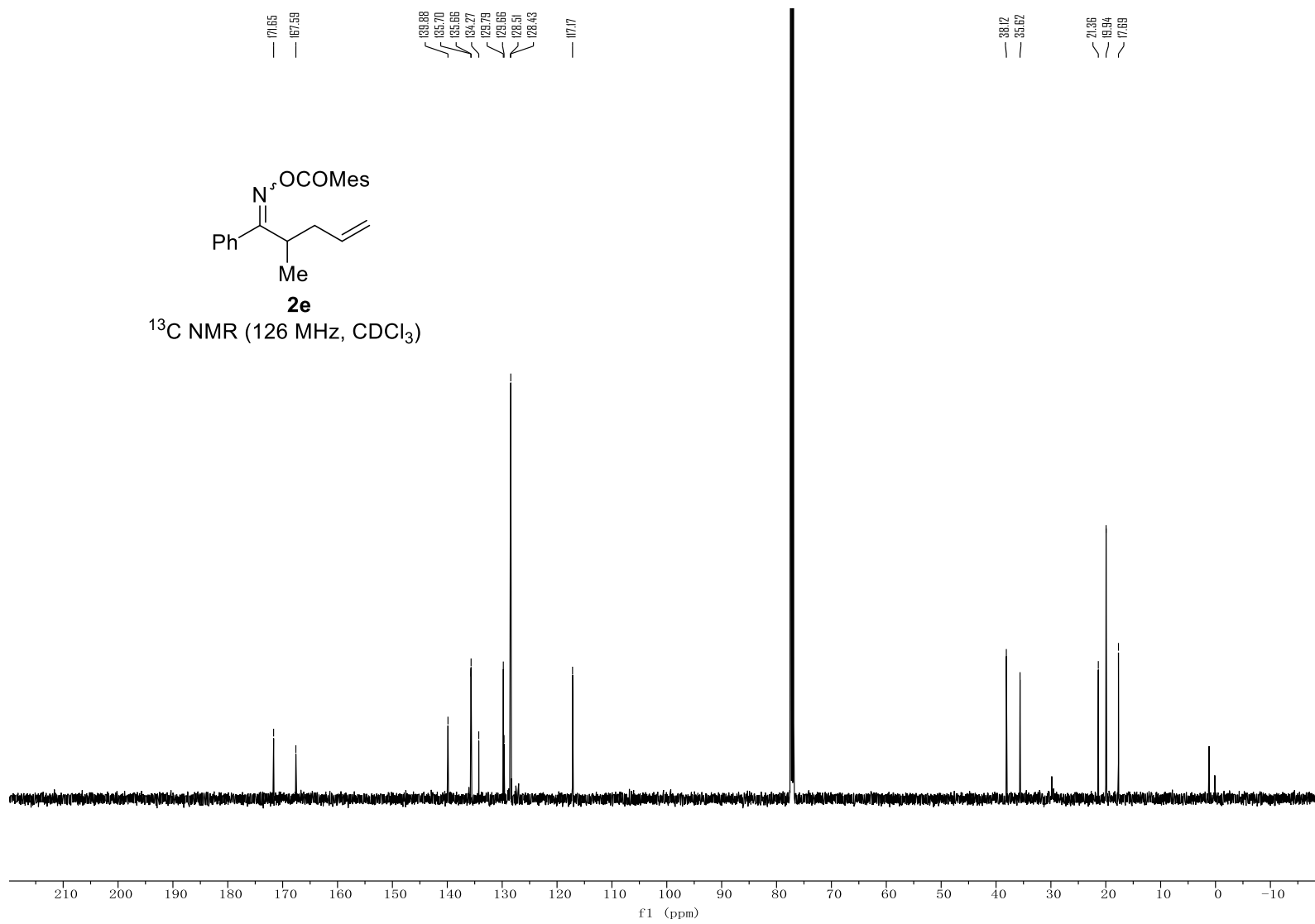
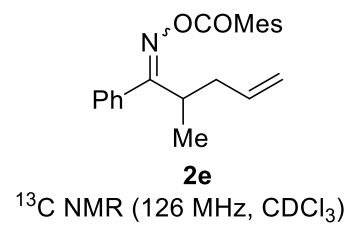
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- [3] Wang, L.; Wang, C. Ni-Catalyzed 1,2-Iminoacylation of Alkenes *via* a Reductive Strategy. *Org. Chem. Front.* **2018**, *5*, 3476–3482.
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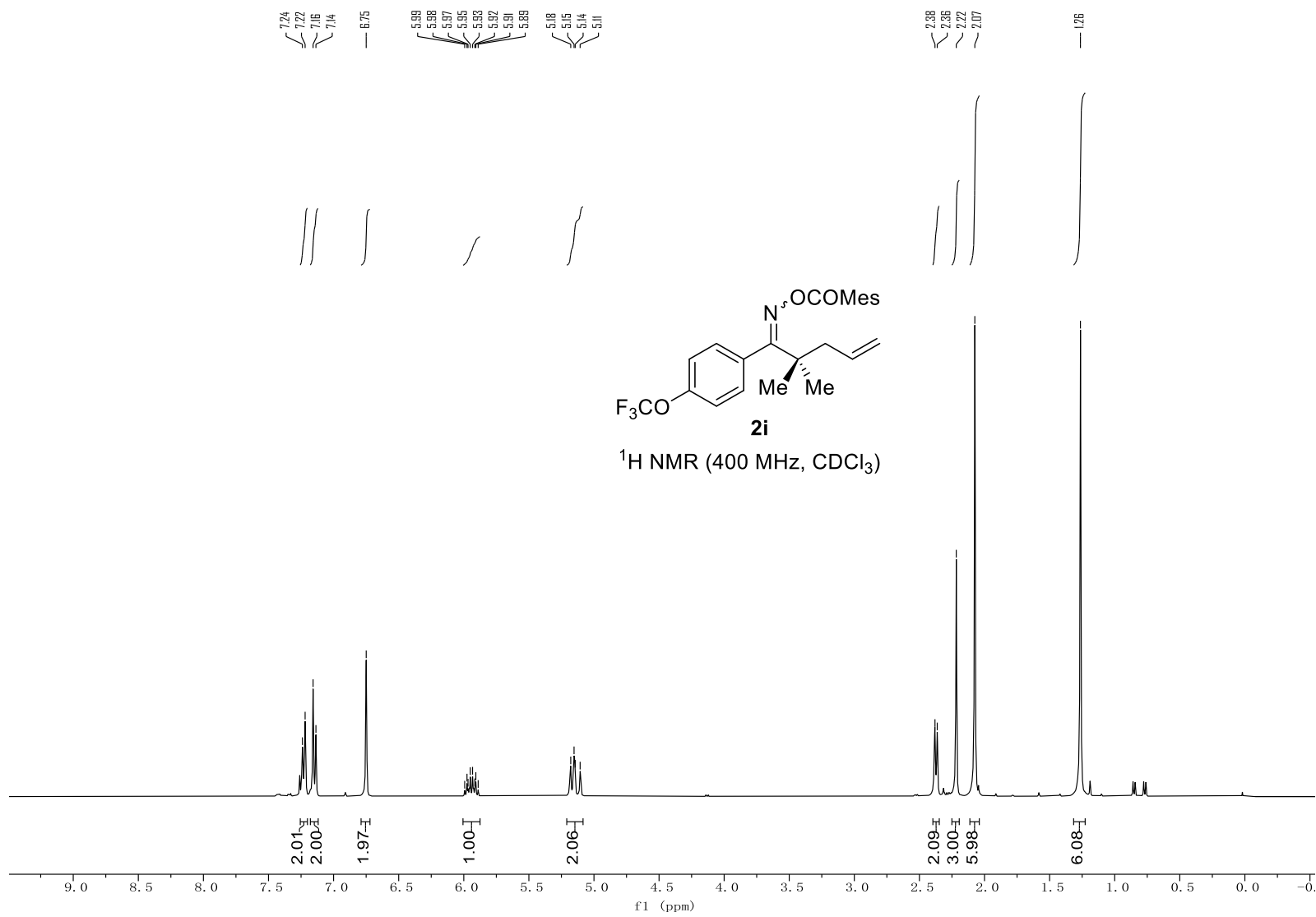
^1H , ^{13}C , and ^{19}F -NMR Spectra

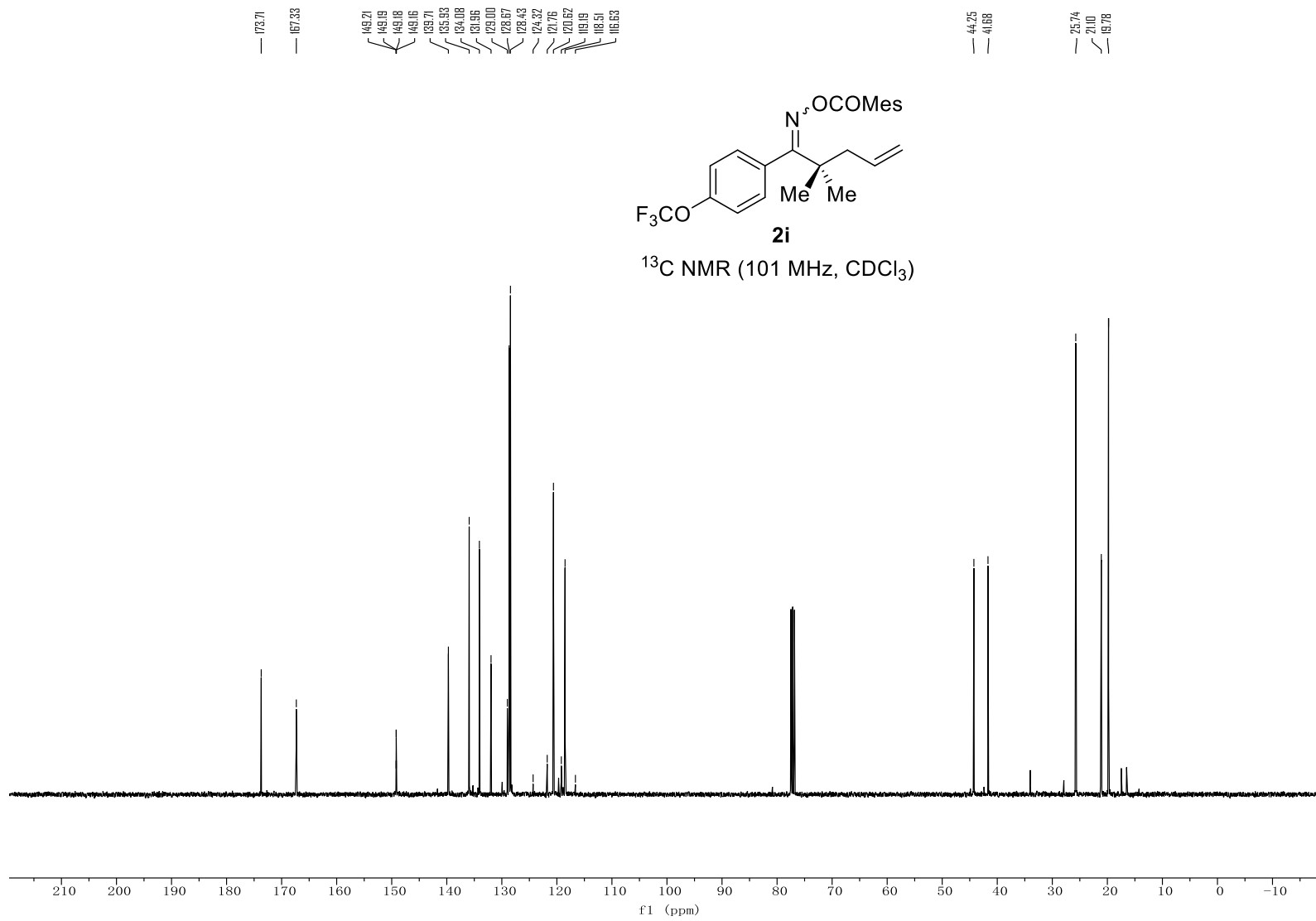


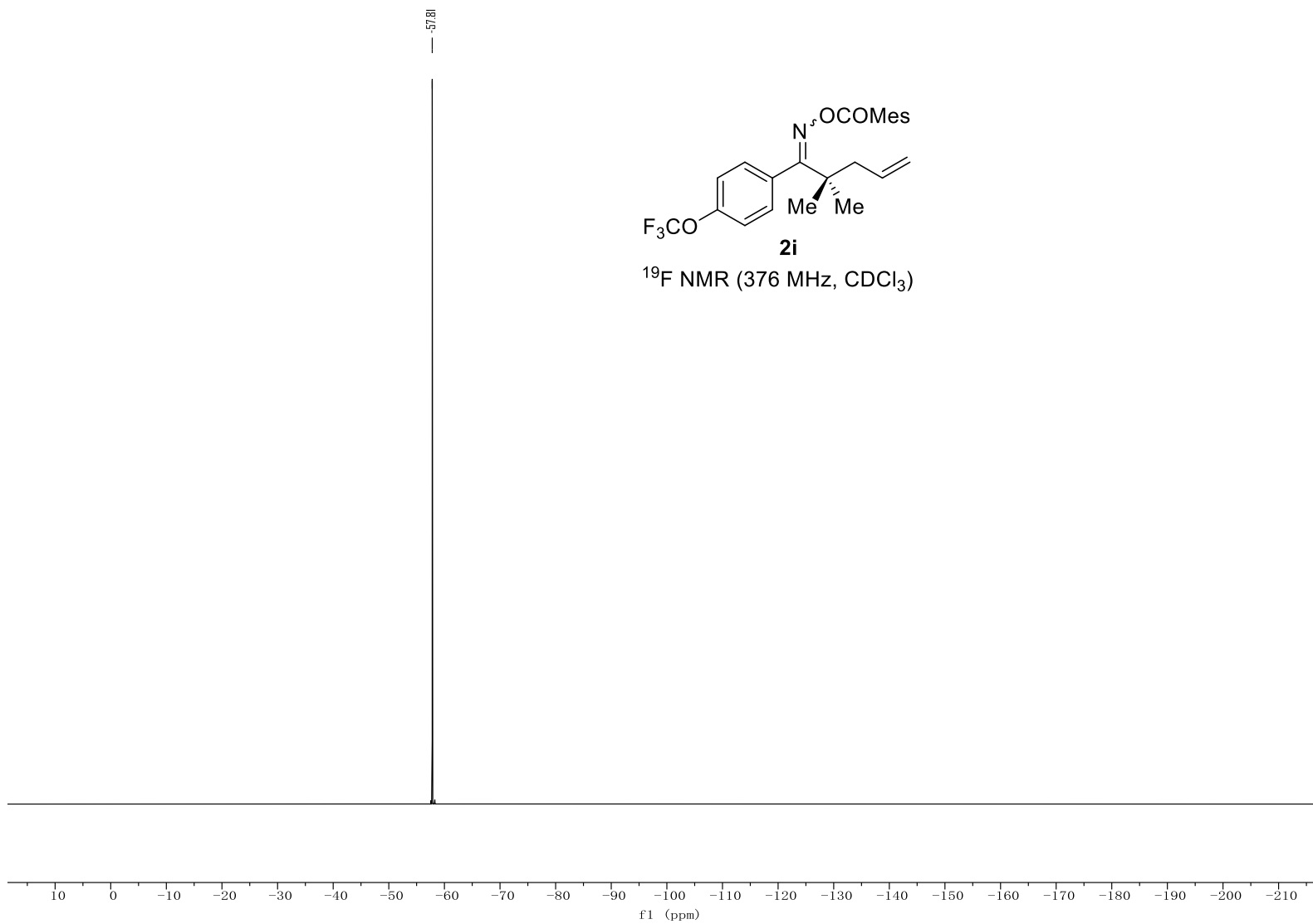
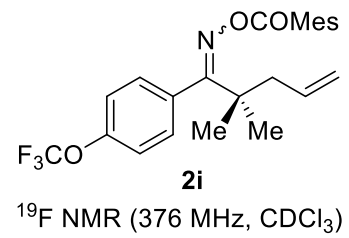


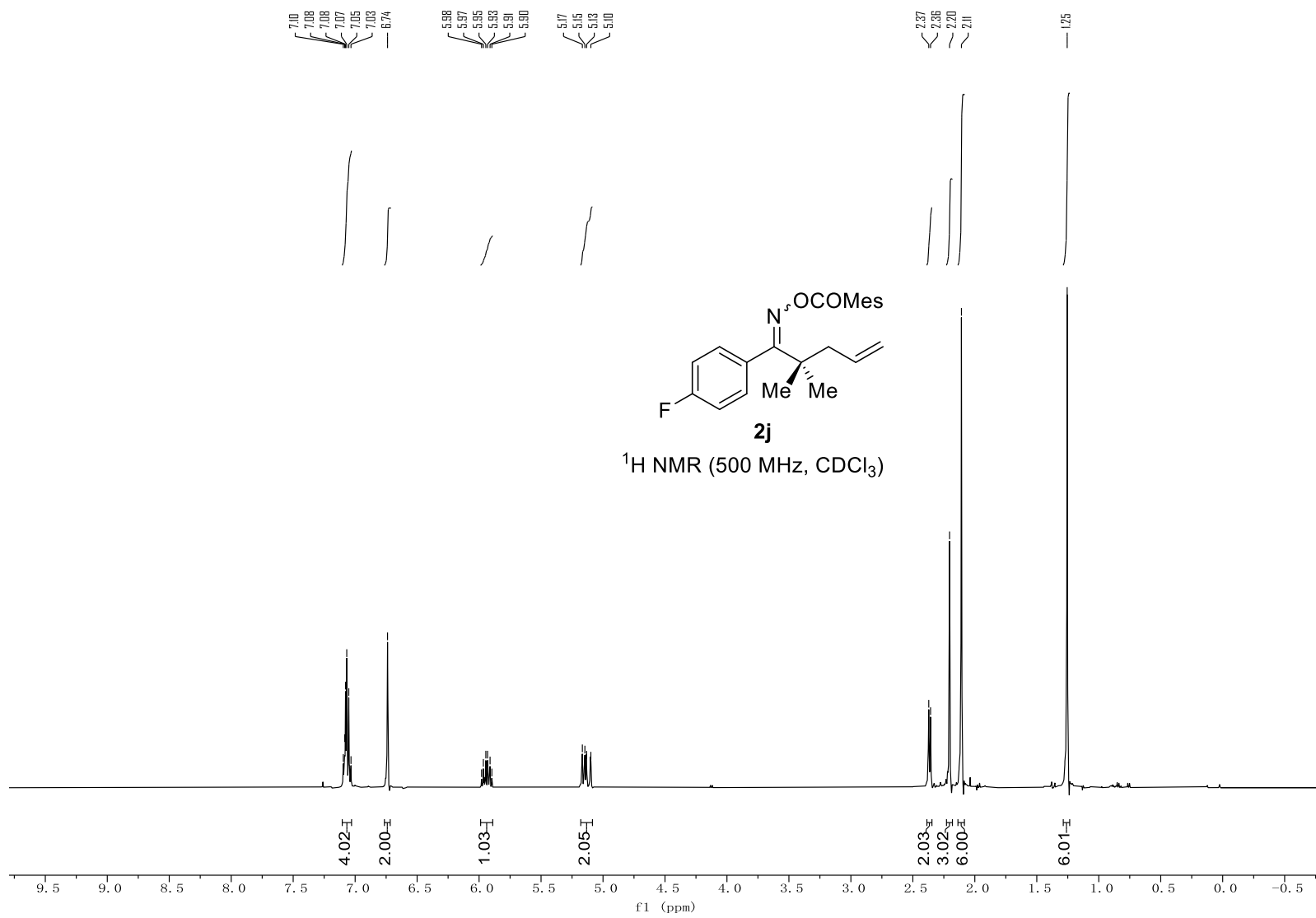


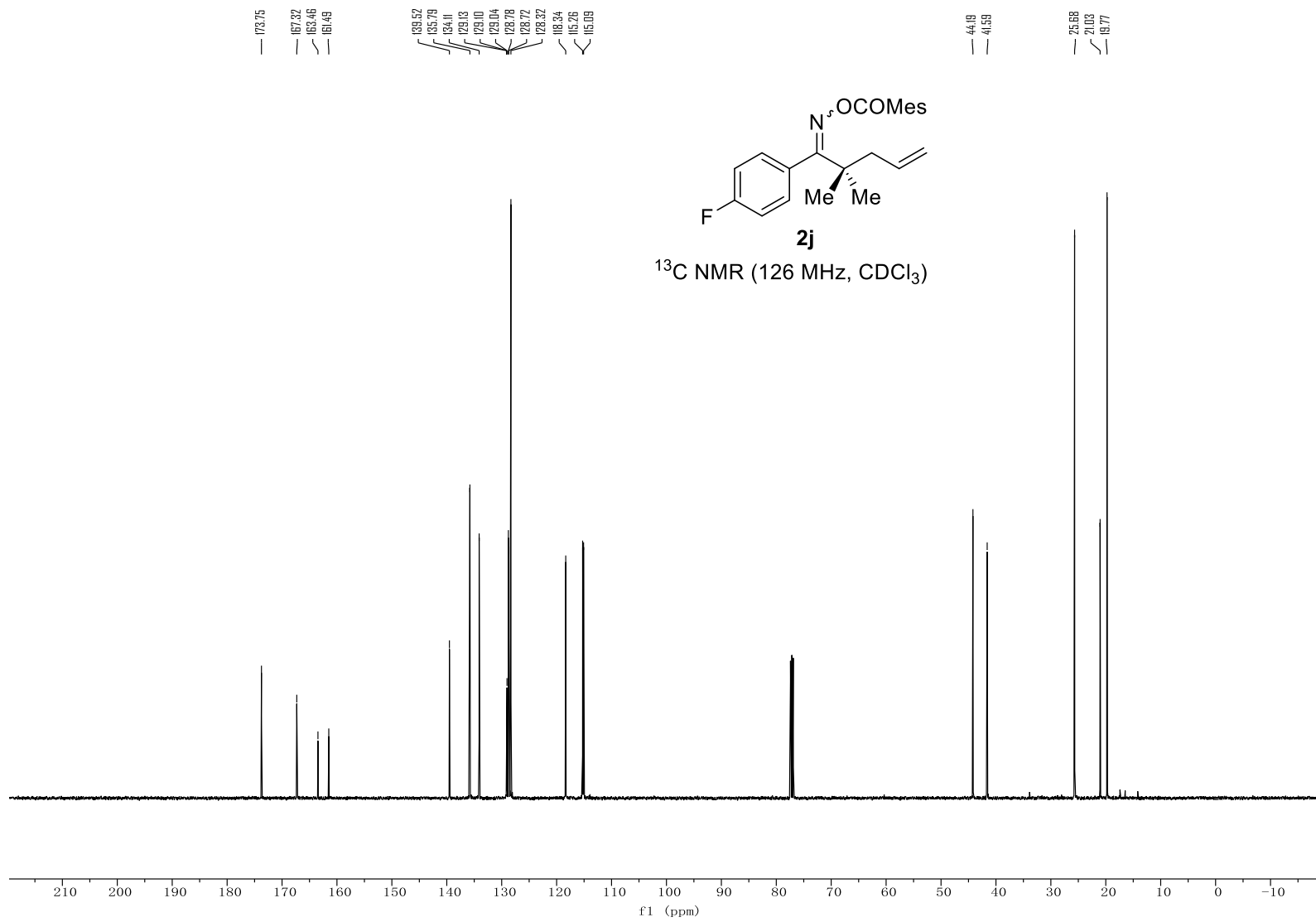


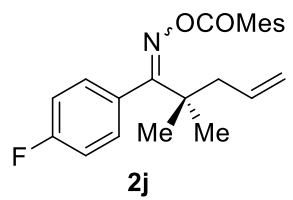




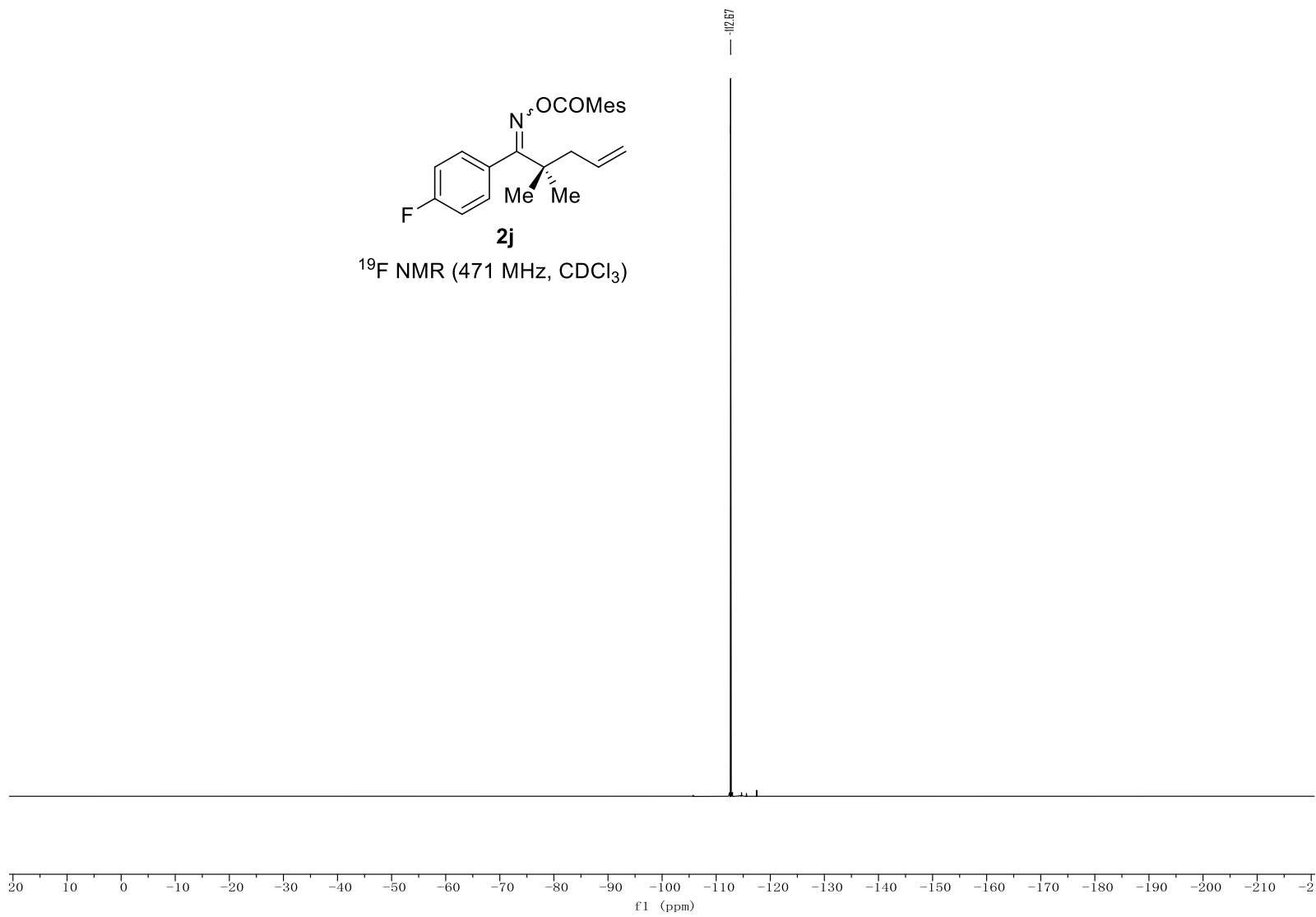


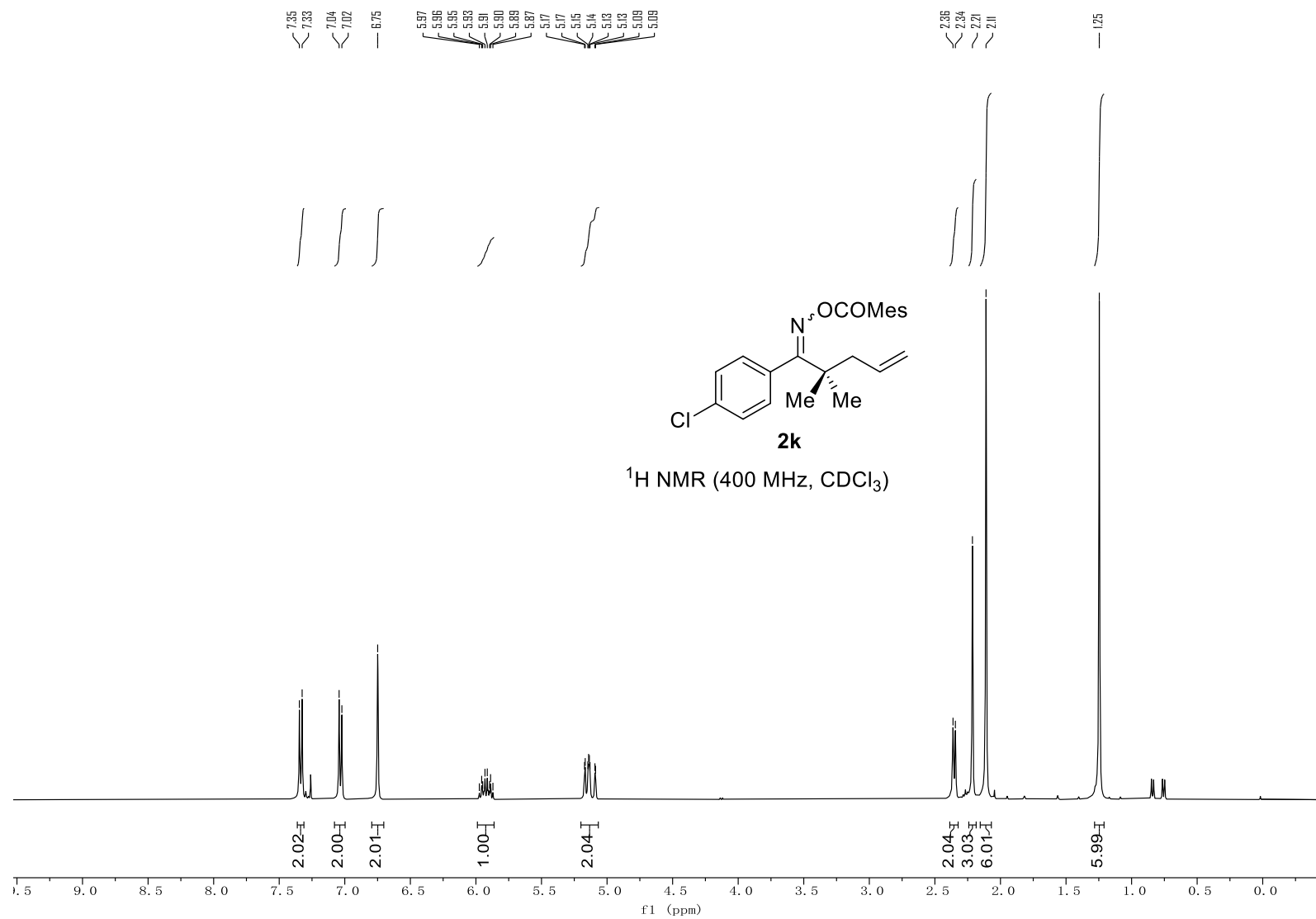


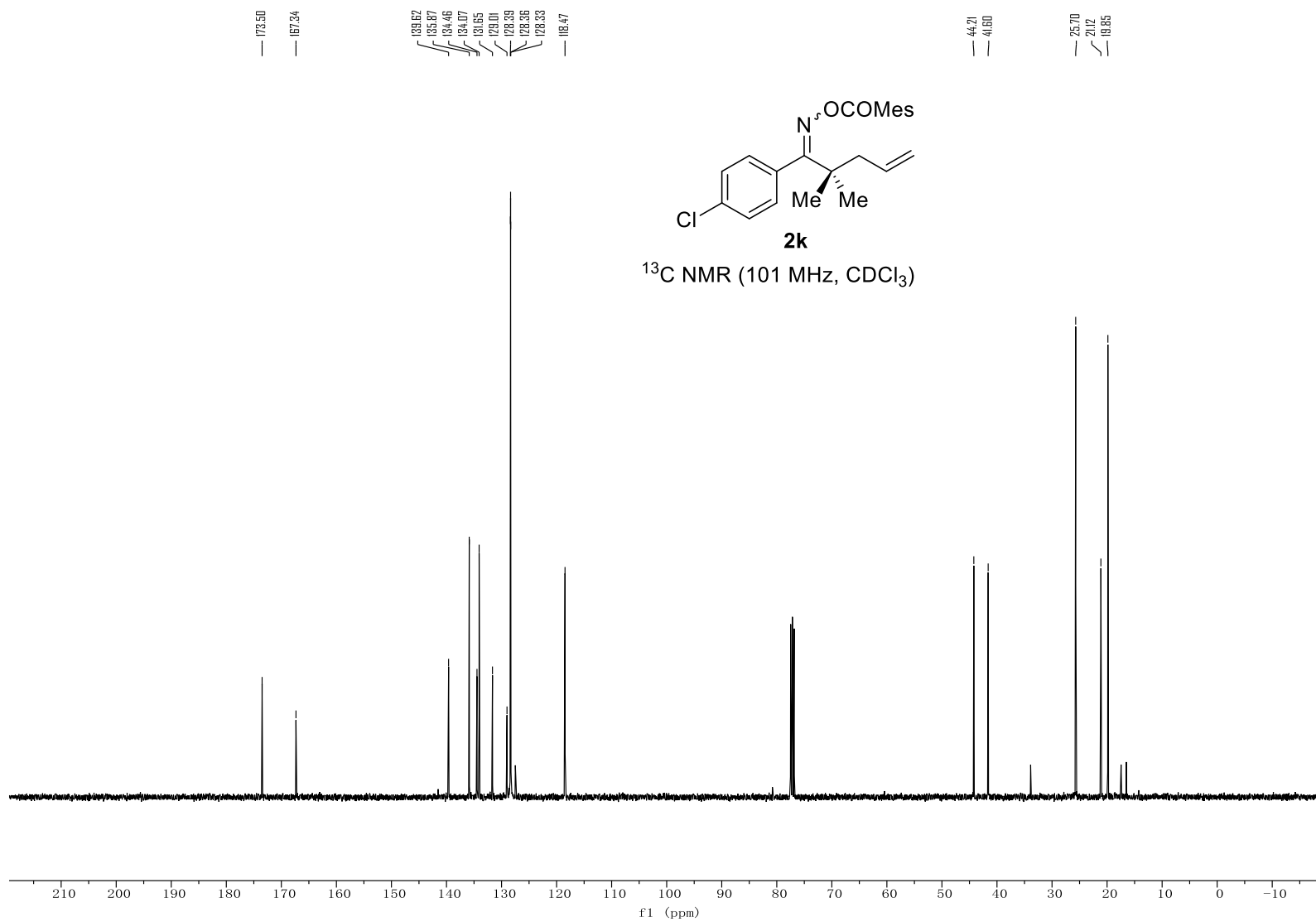


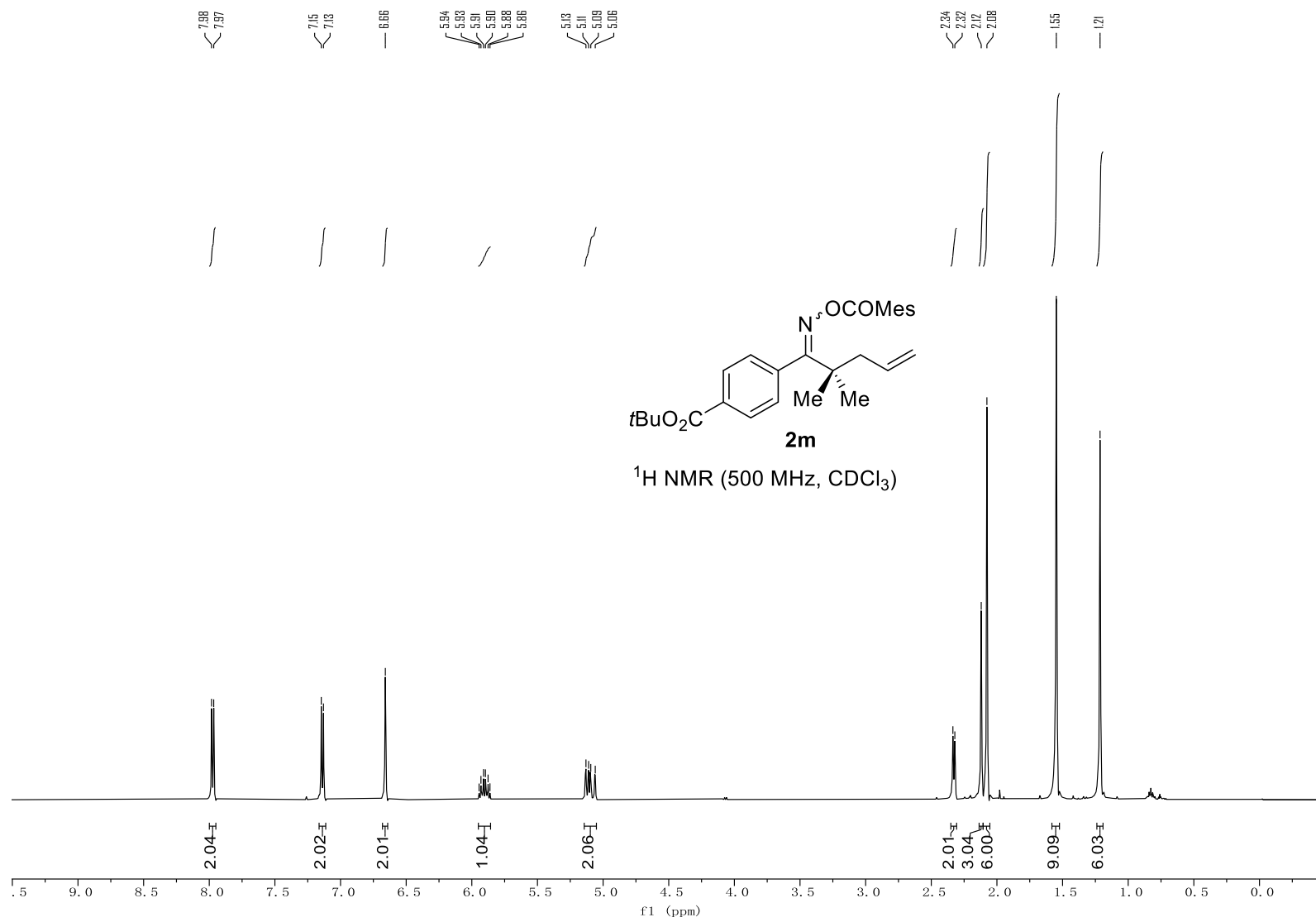


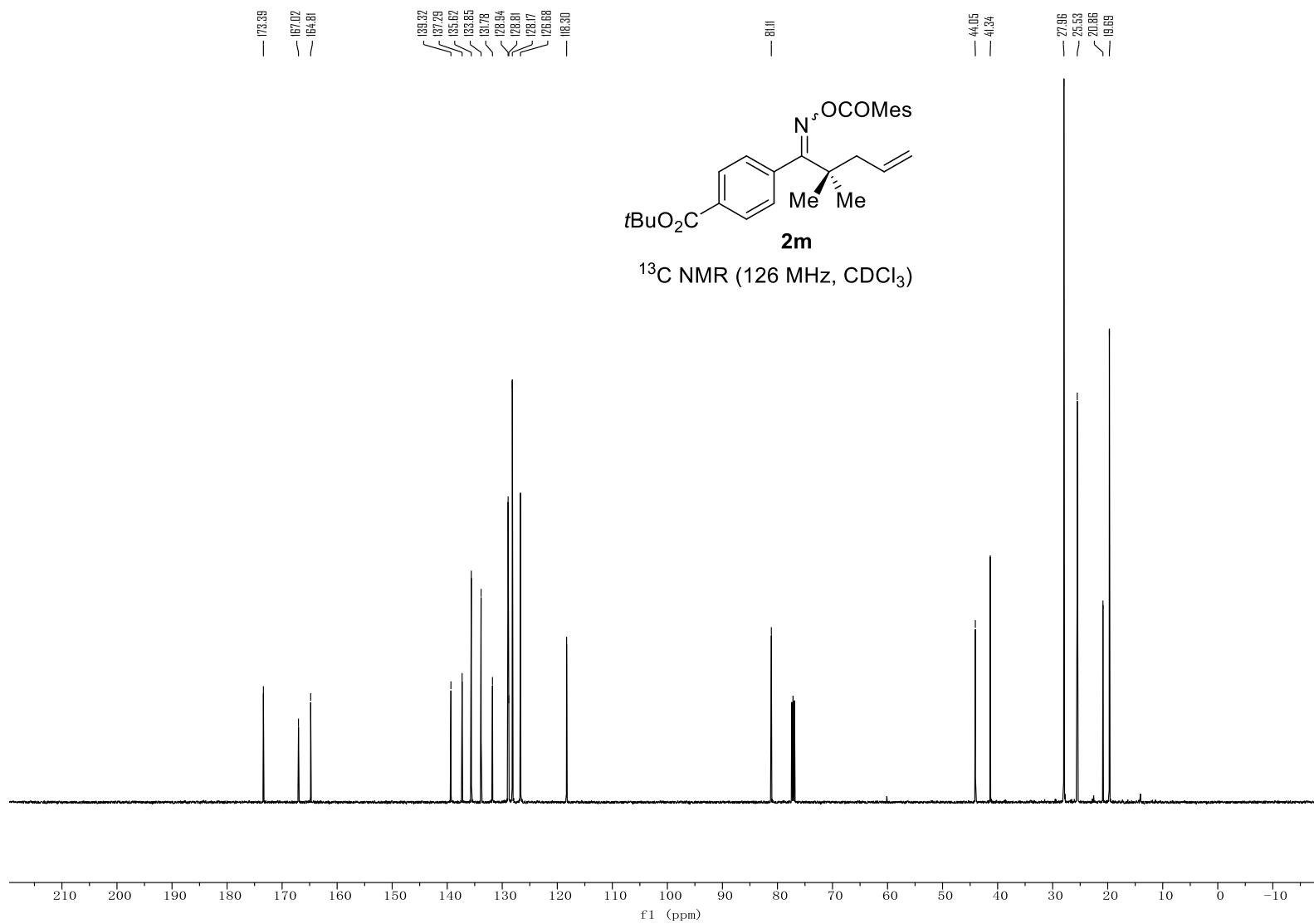
¹⁹F NMR (471 MHz, CDCl₃)

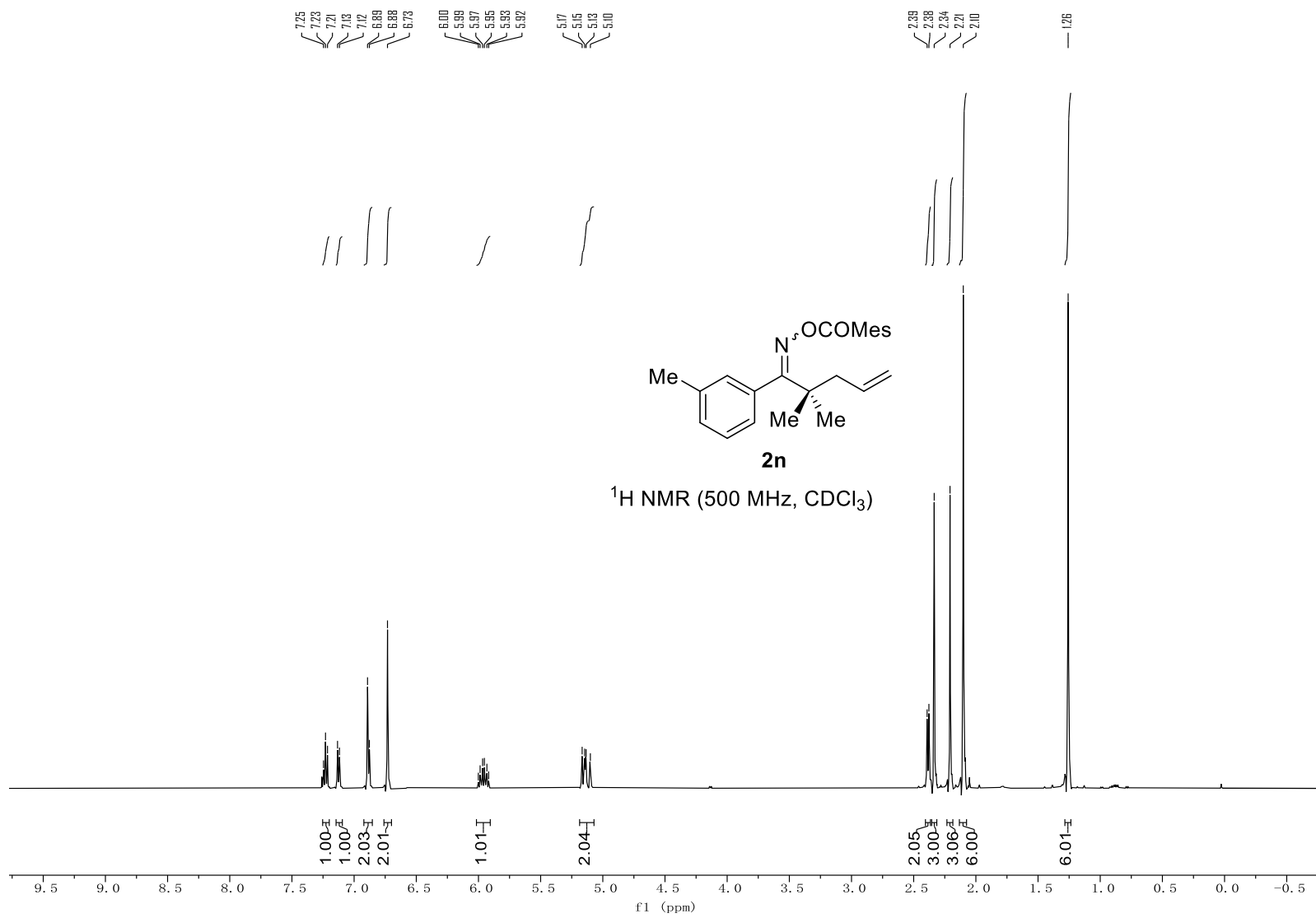


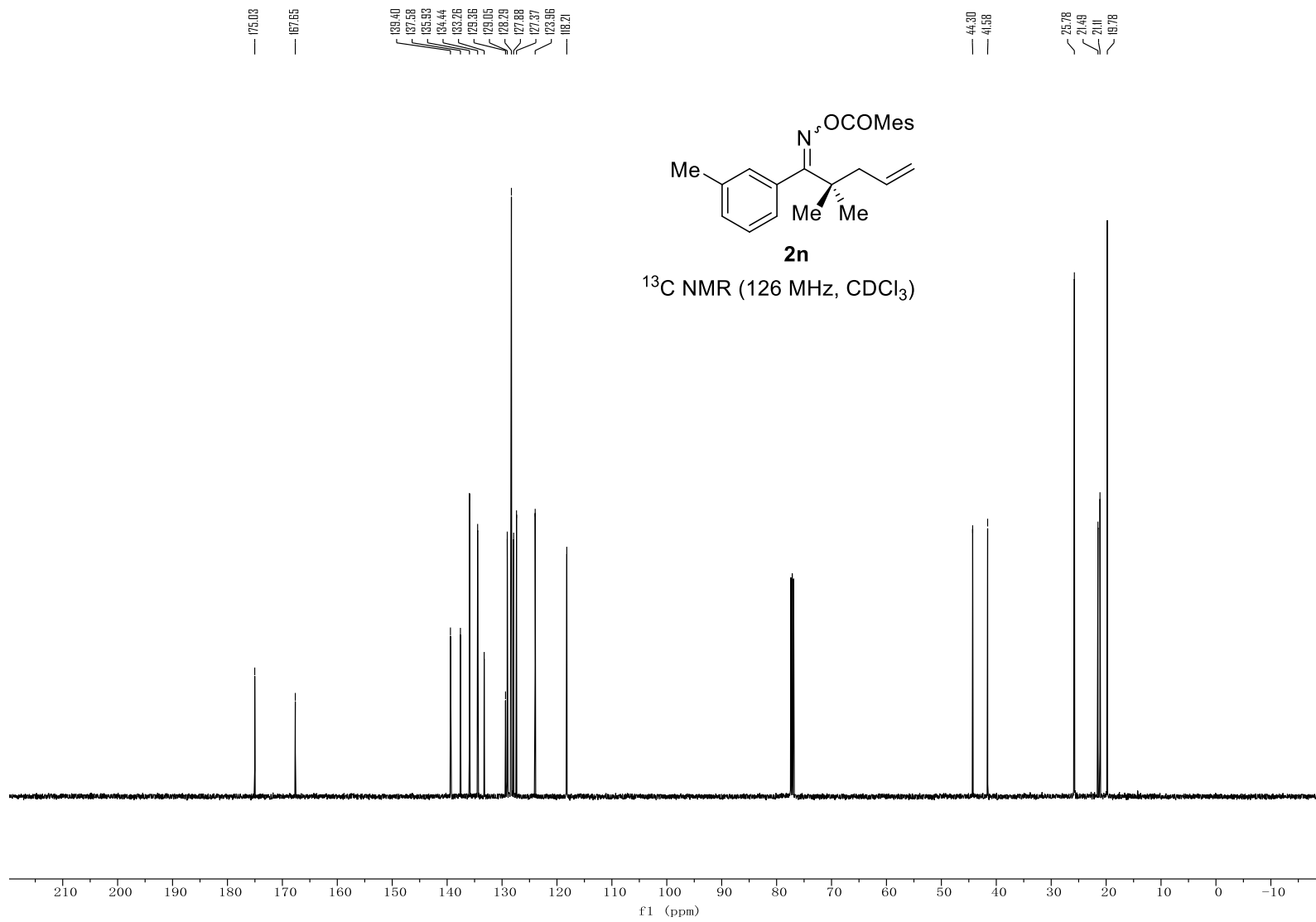


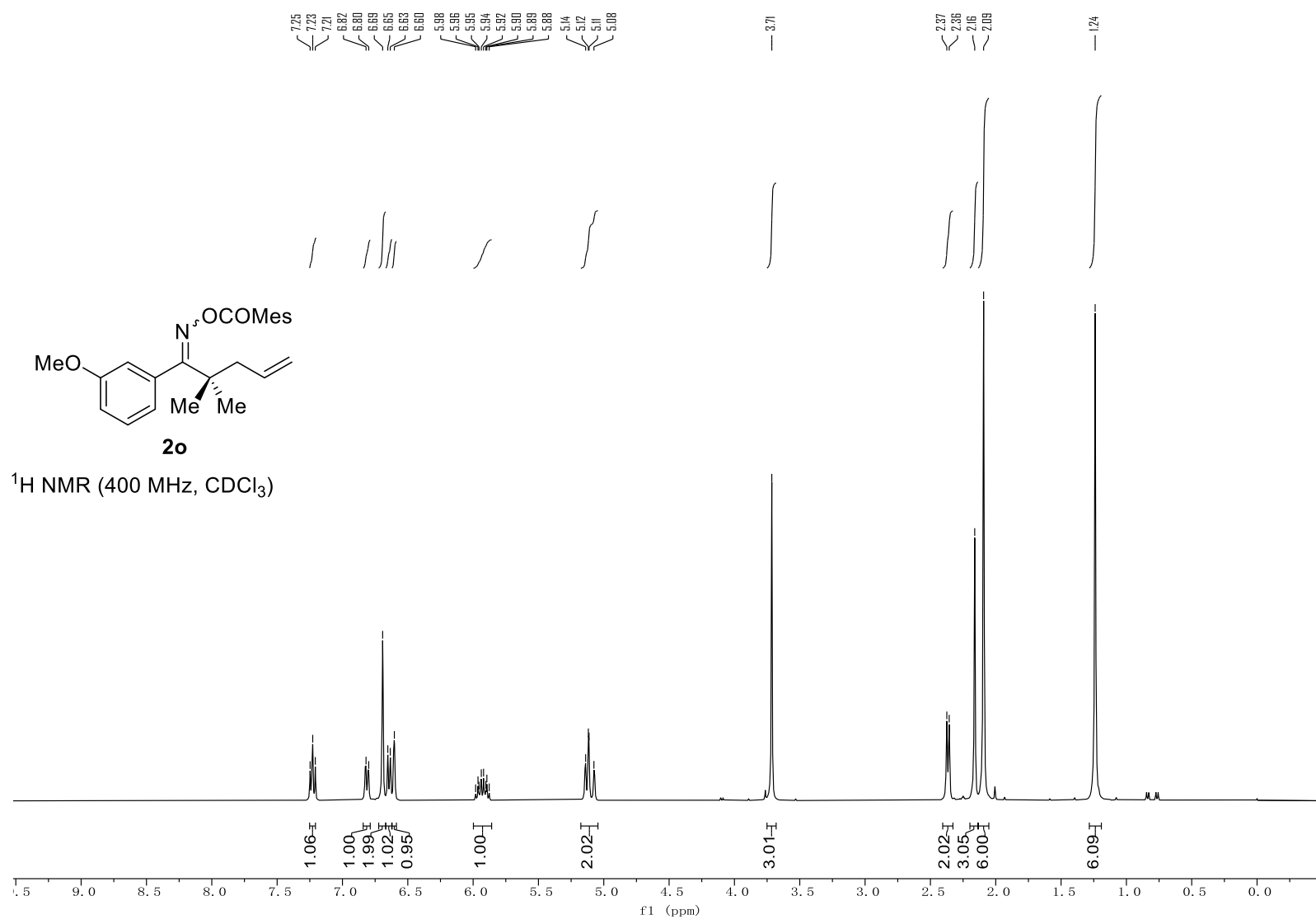


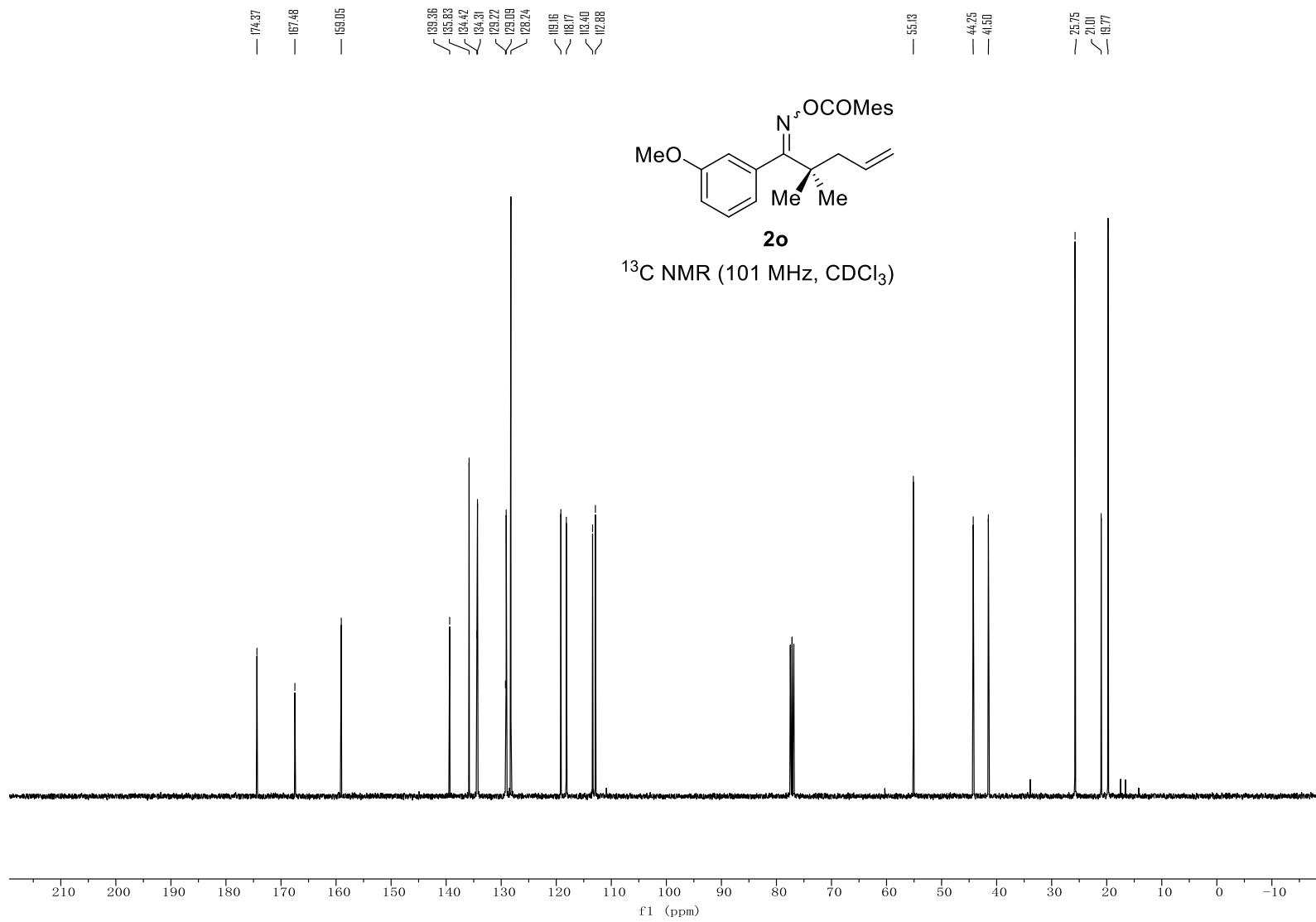


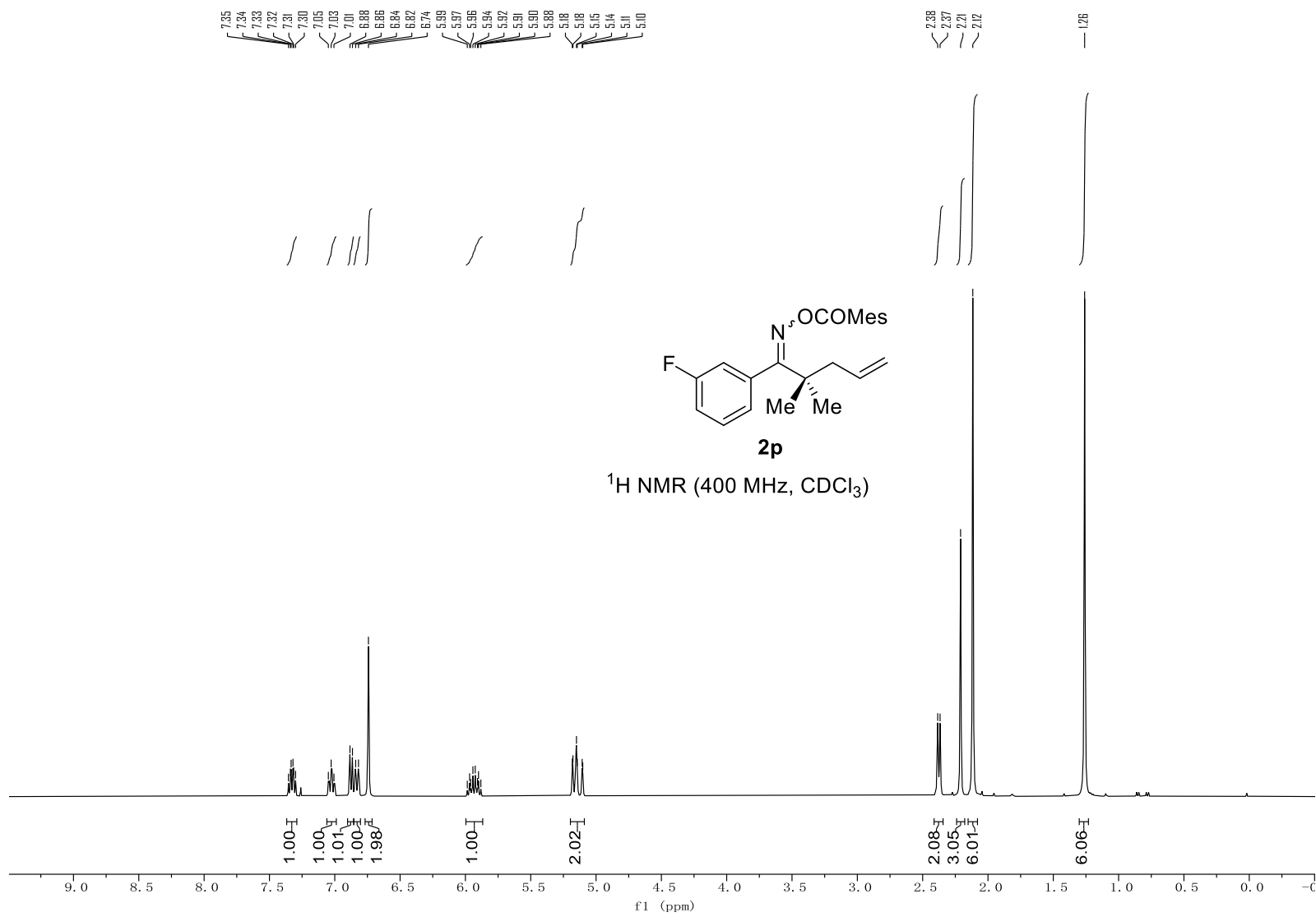


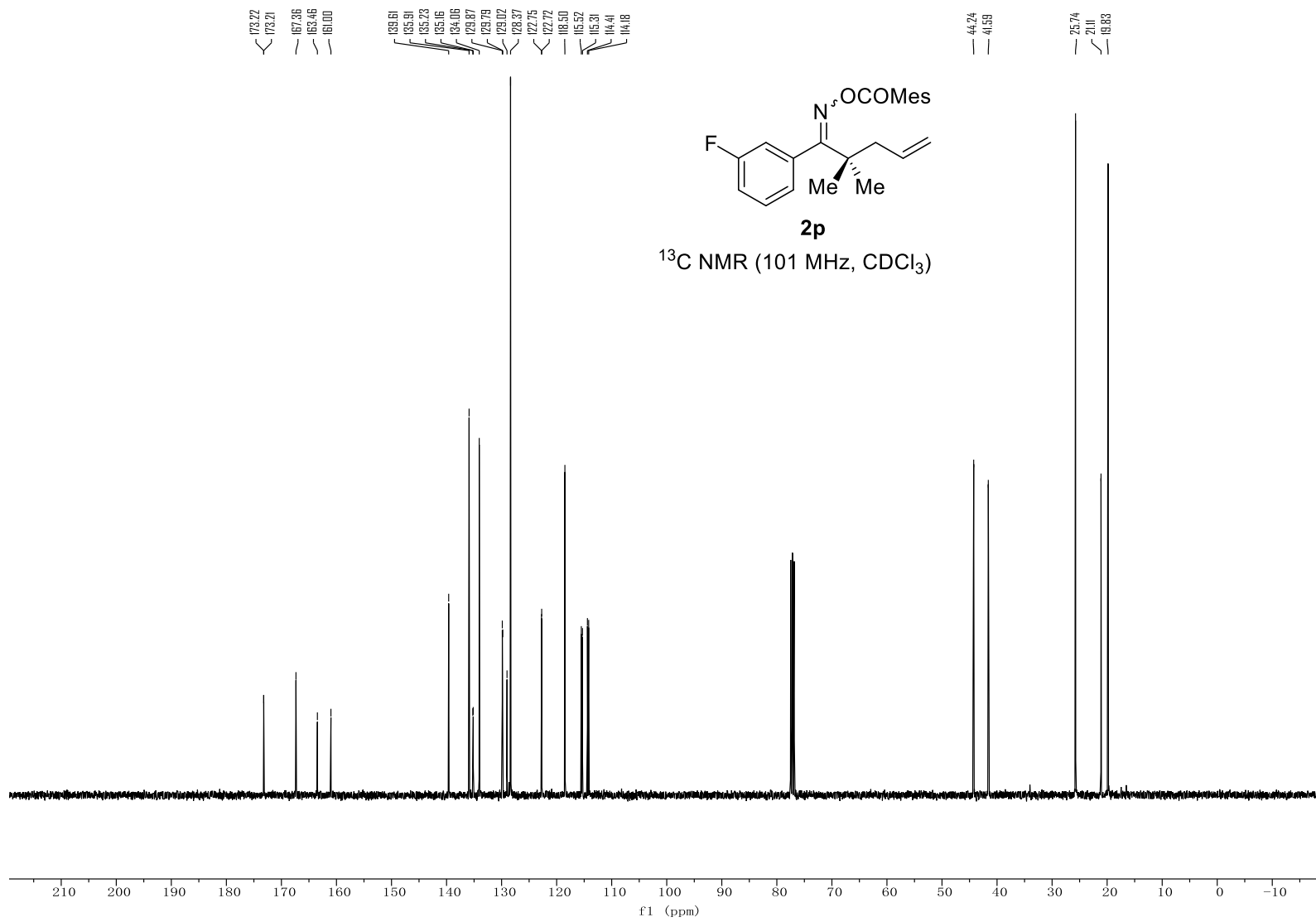


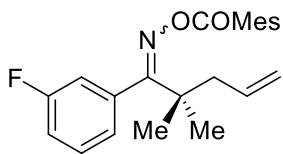






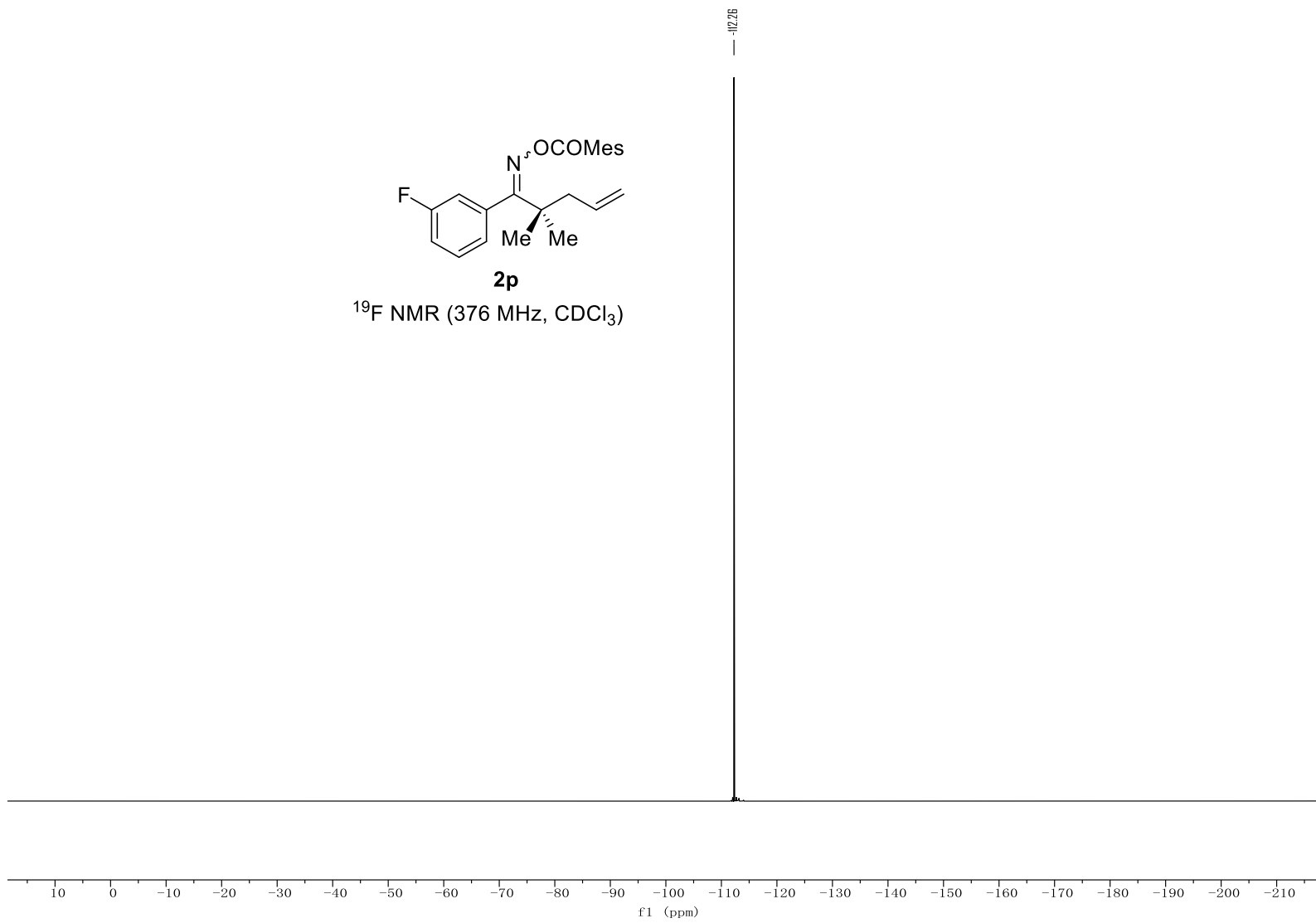


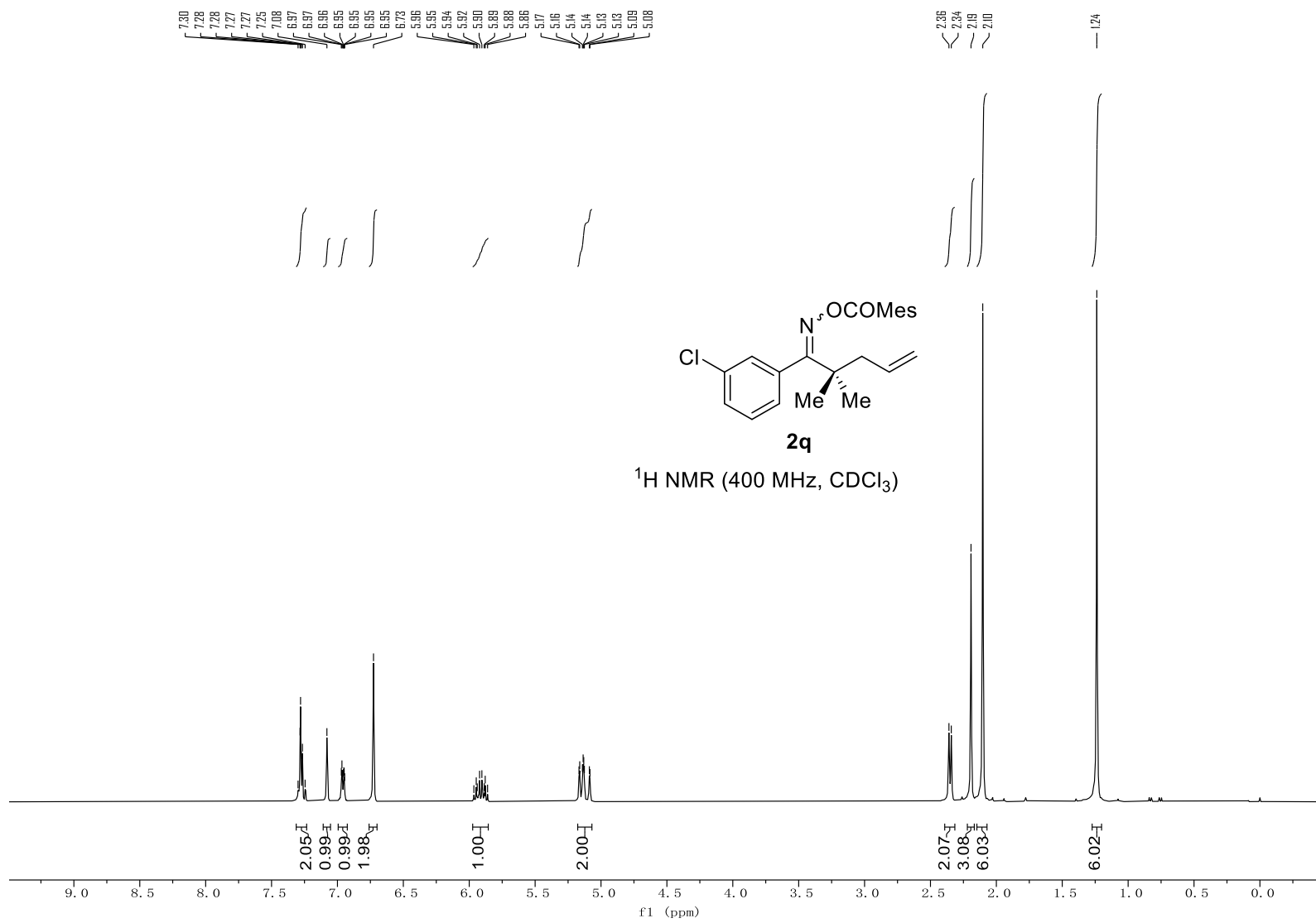


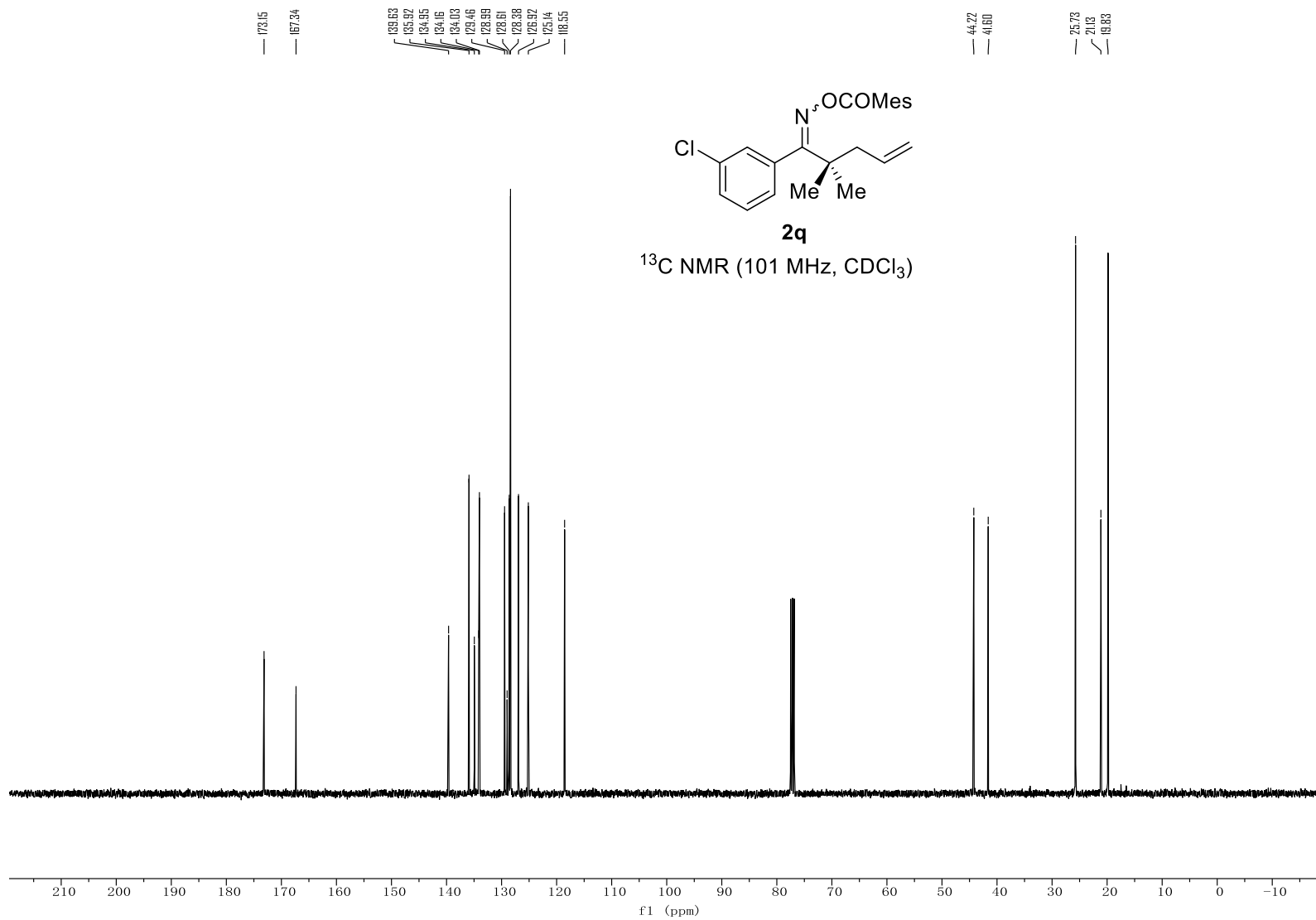


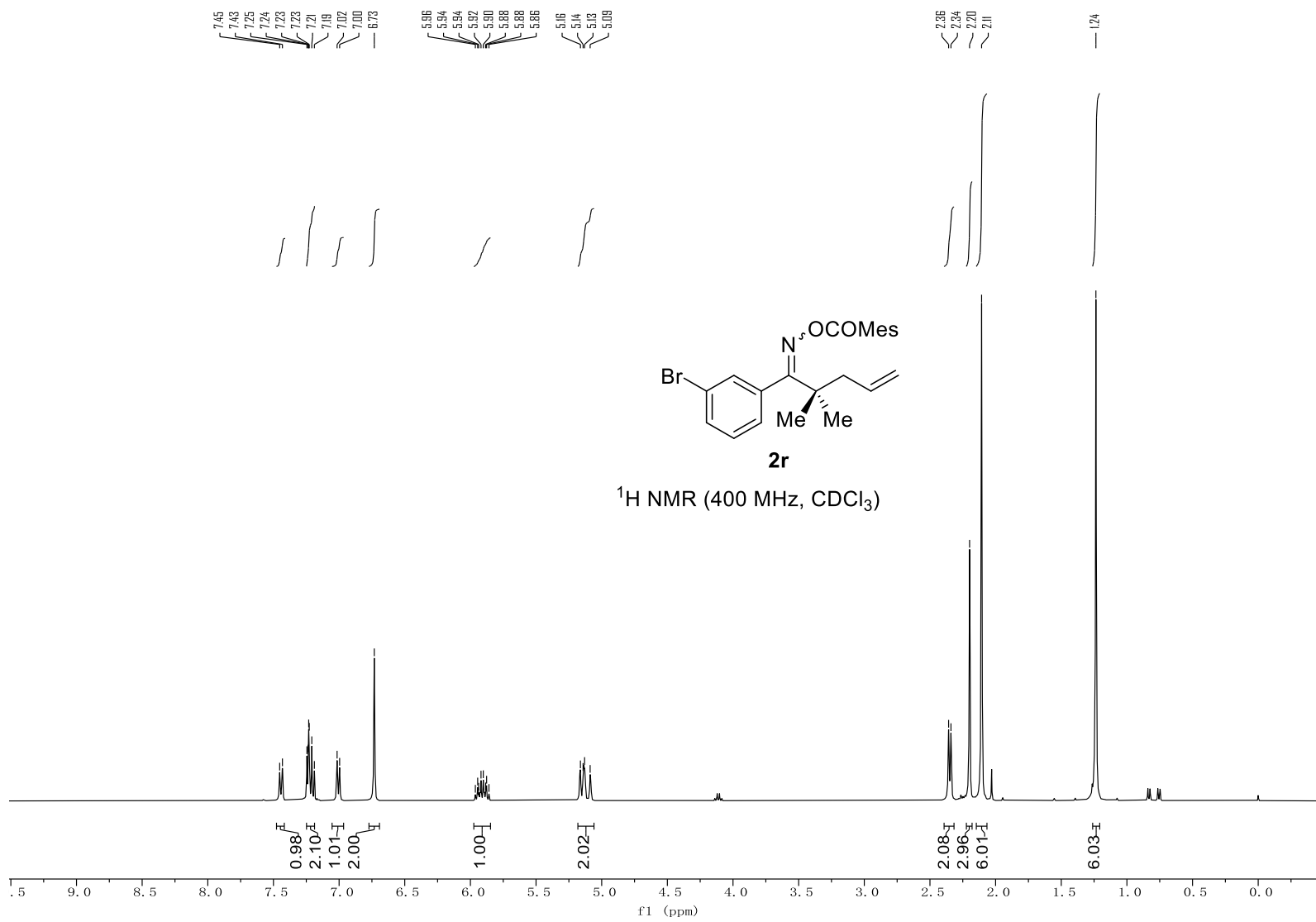
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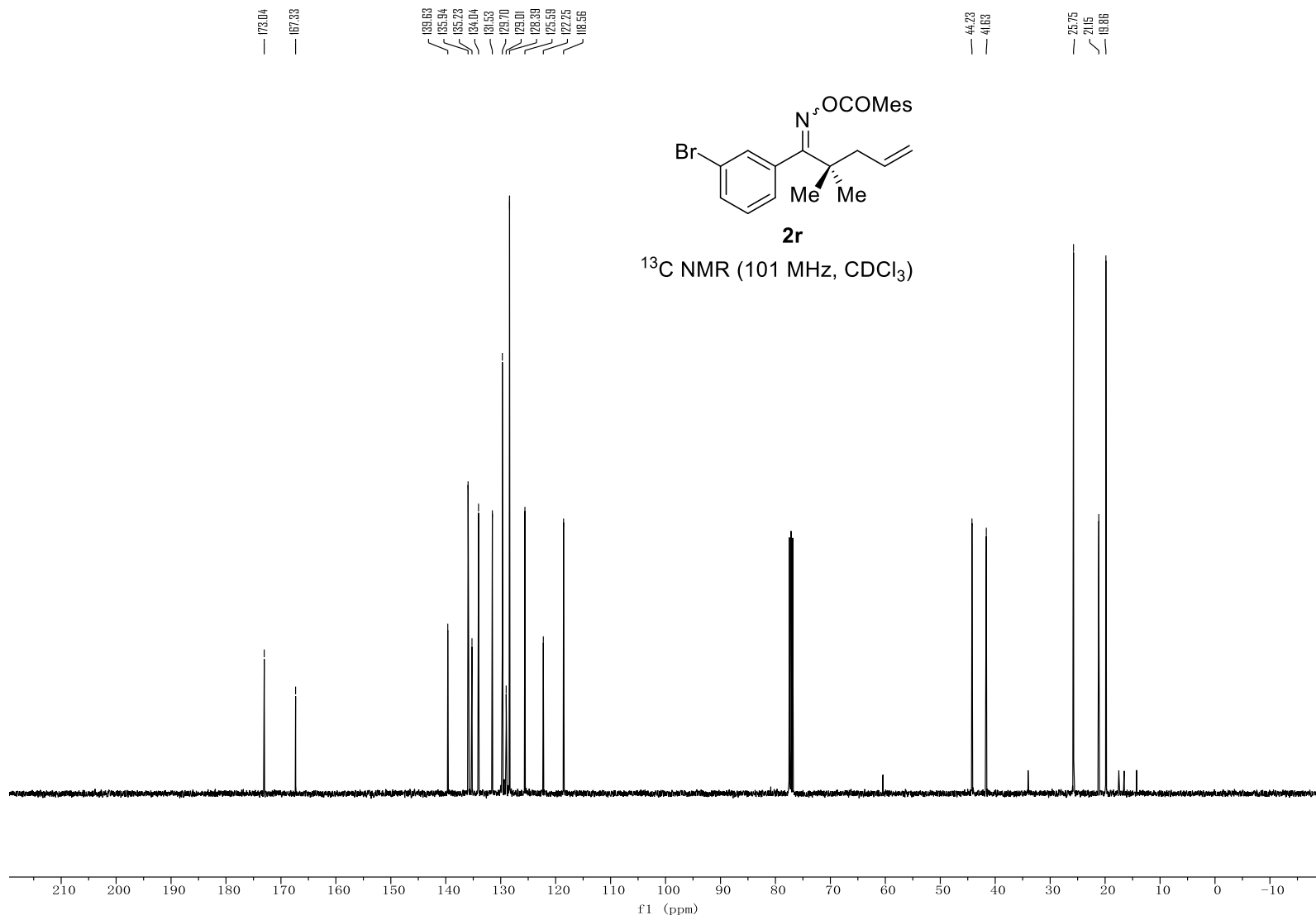
¹⁹F NMR (376 MHz, CDCl₃)

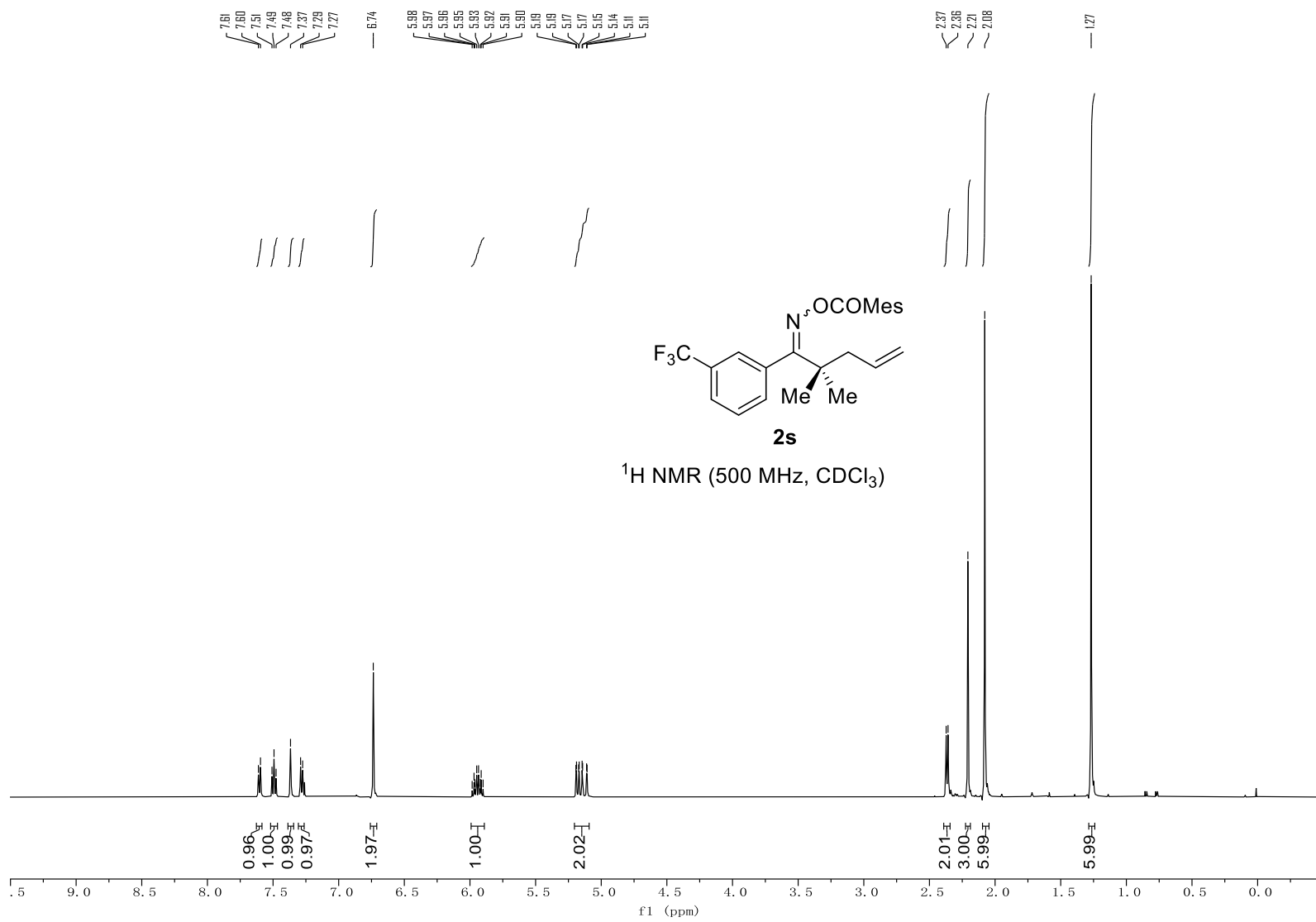


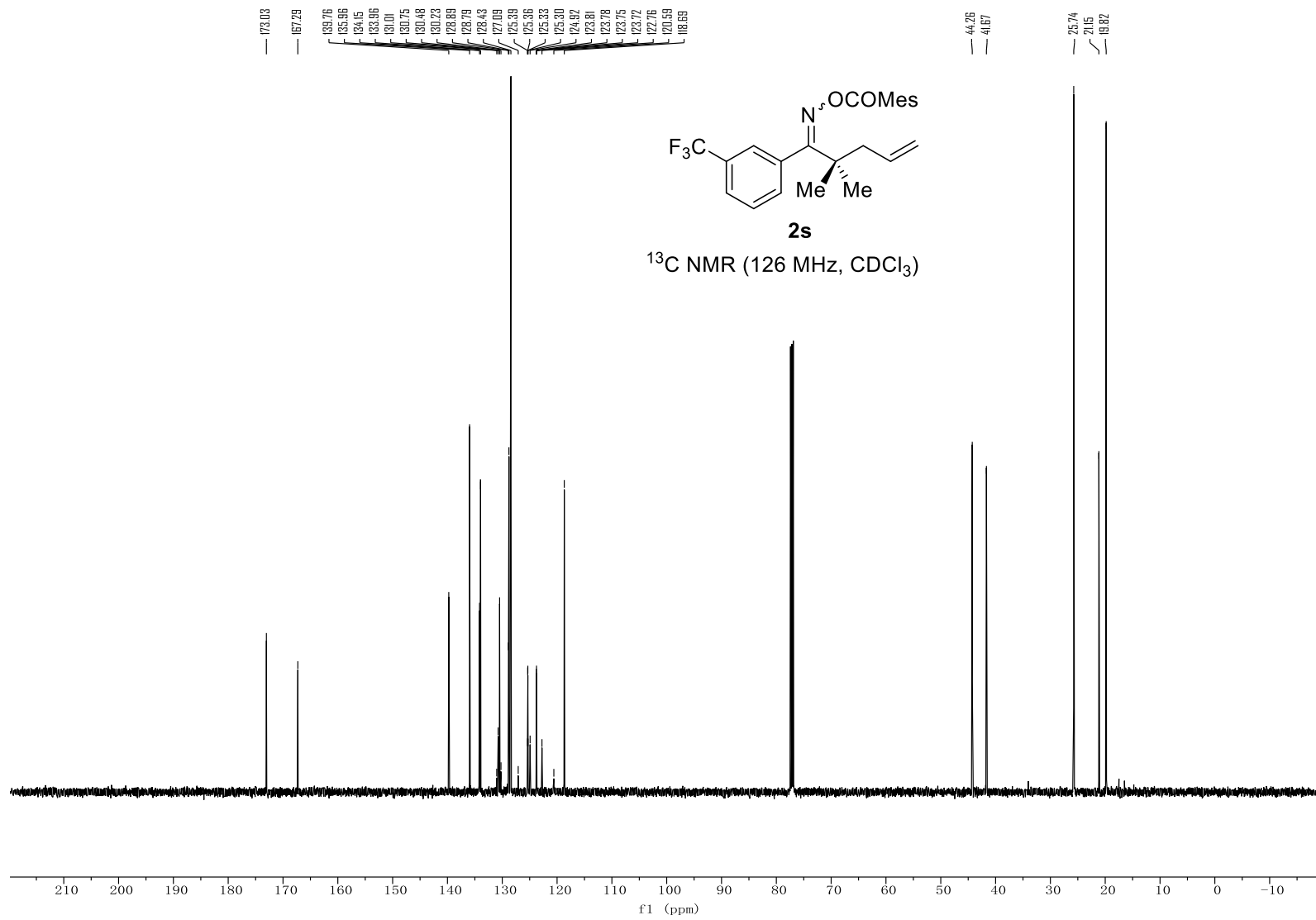


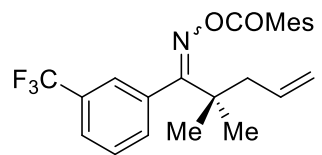






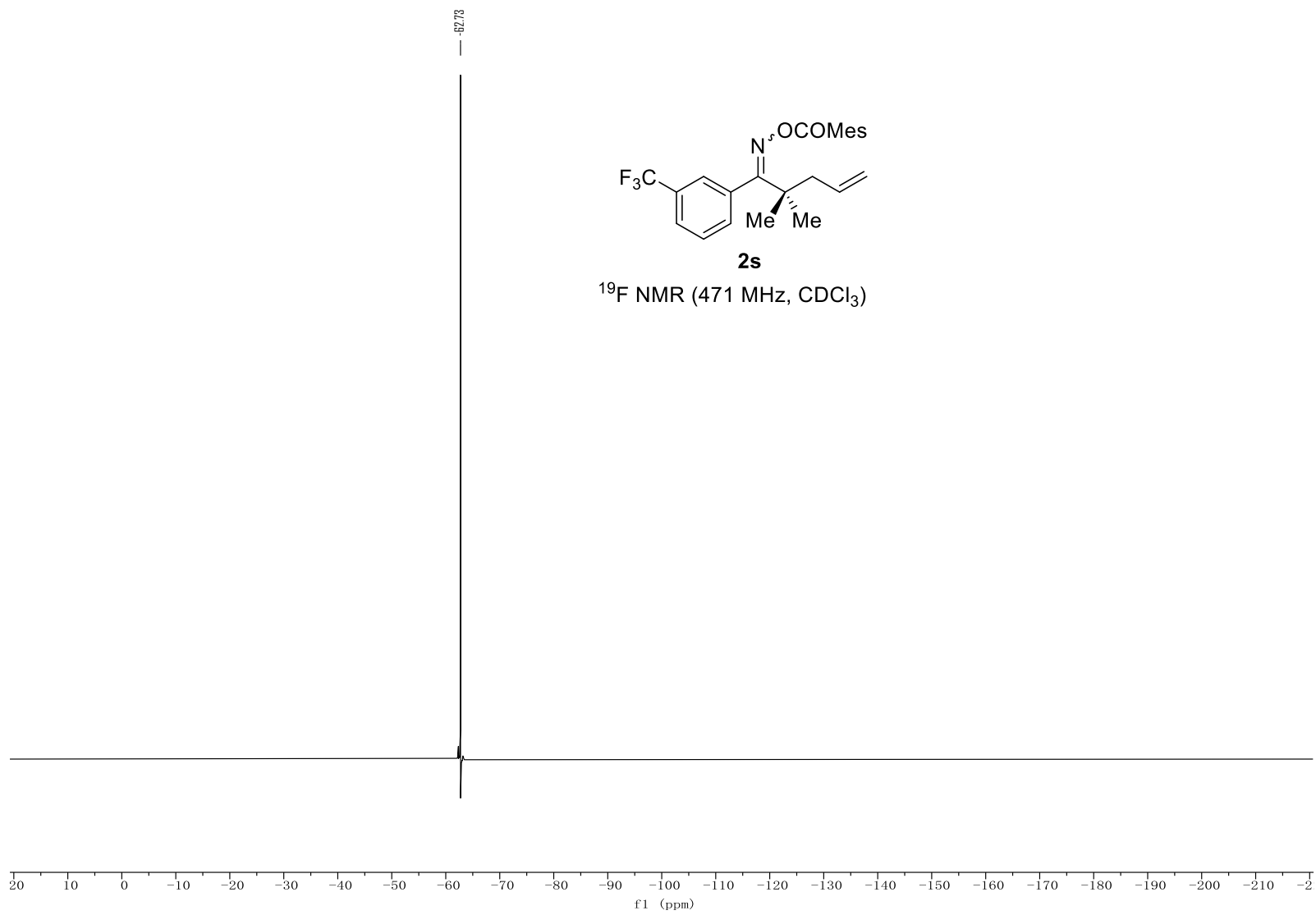


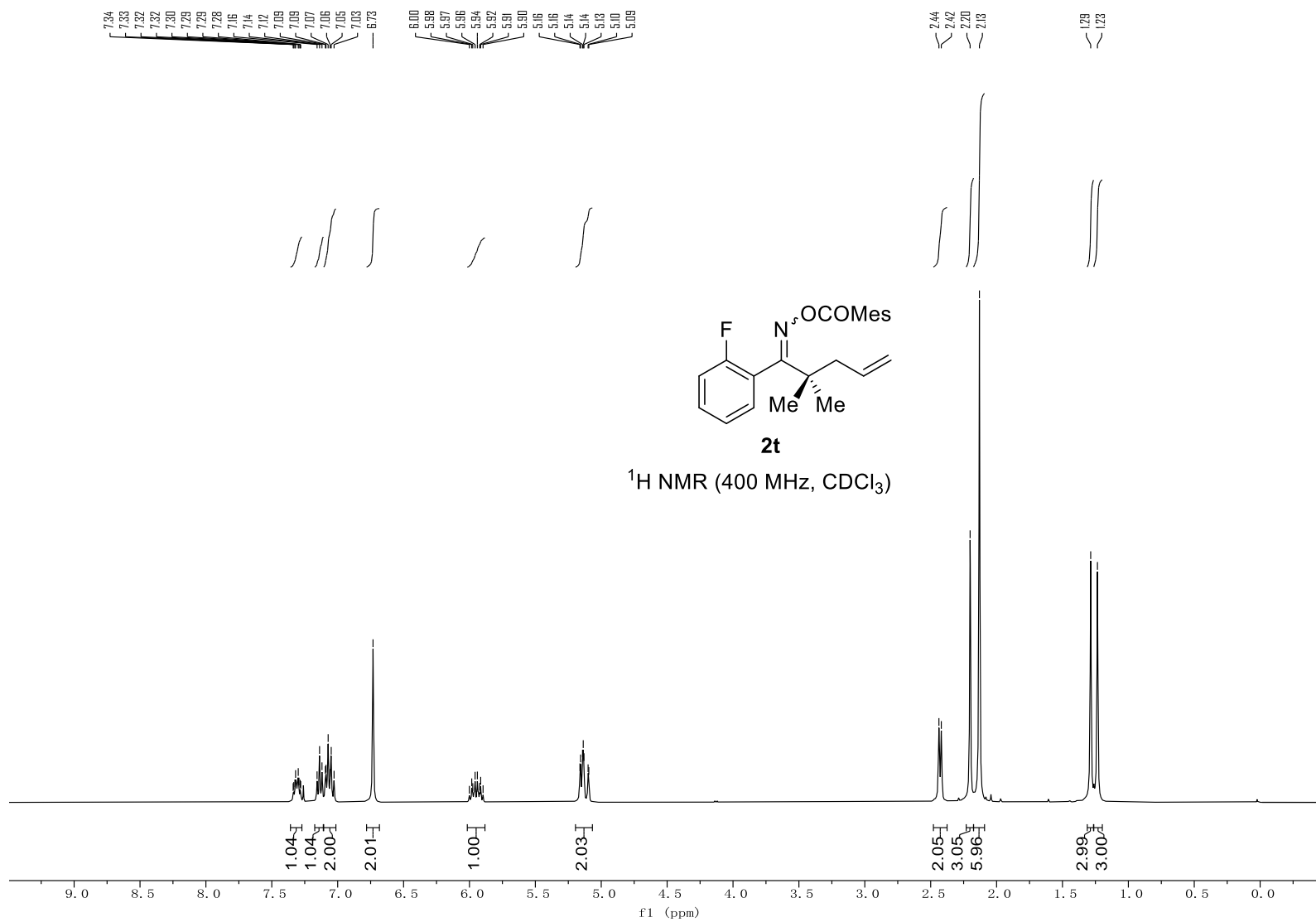


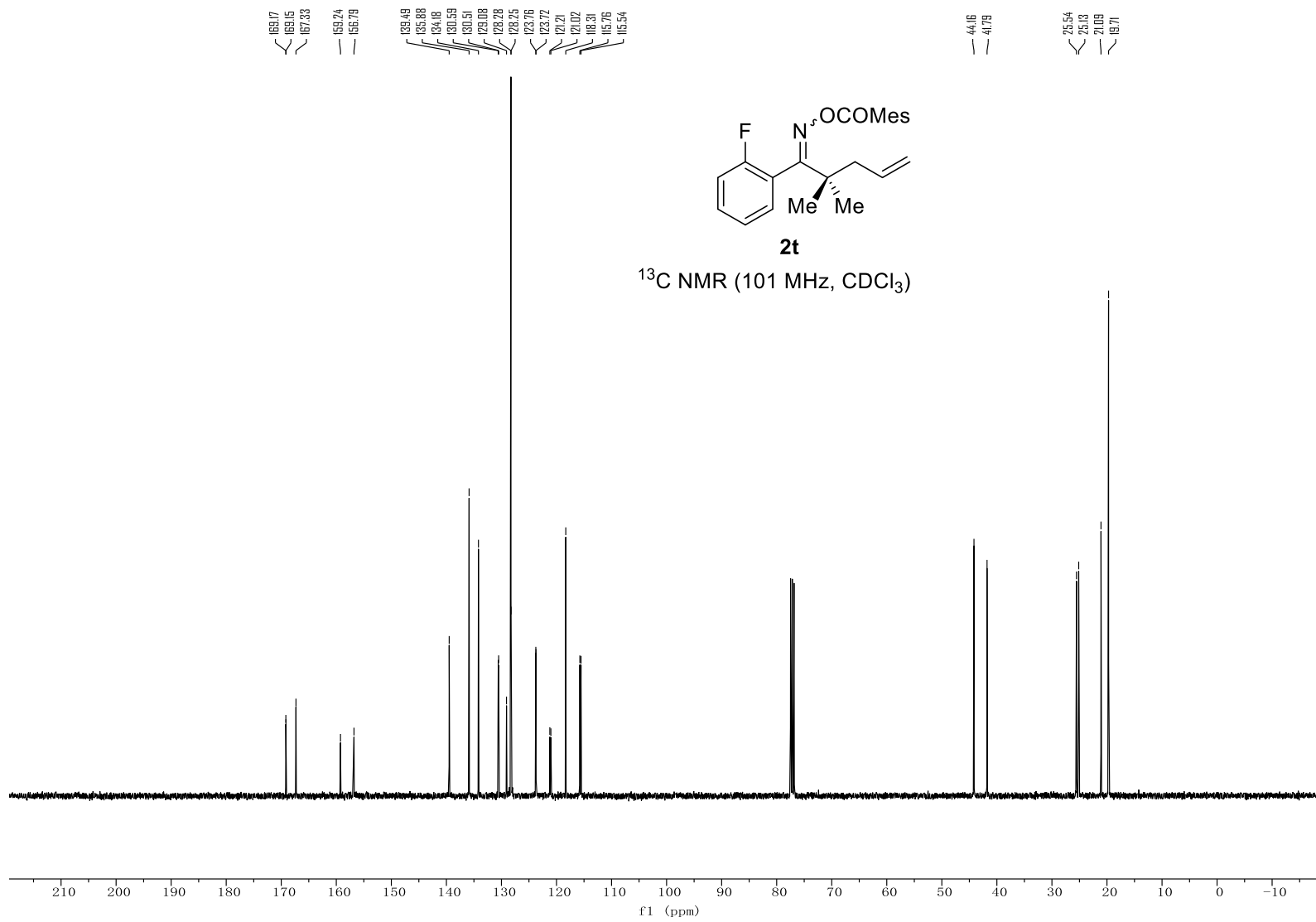


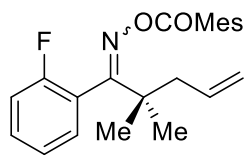
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¹⁹F NMR (471 MHz, CDCl₃)



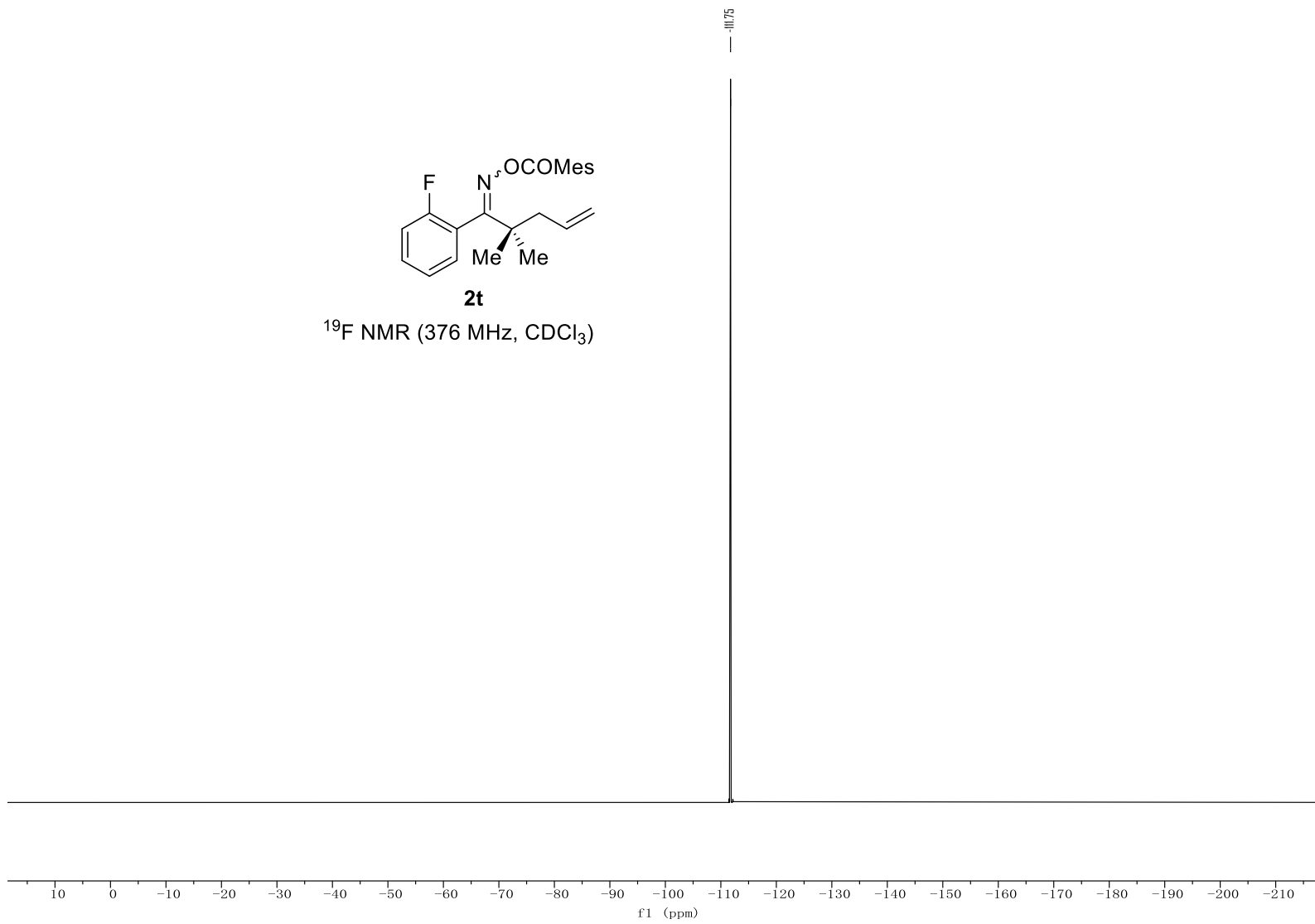


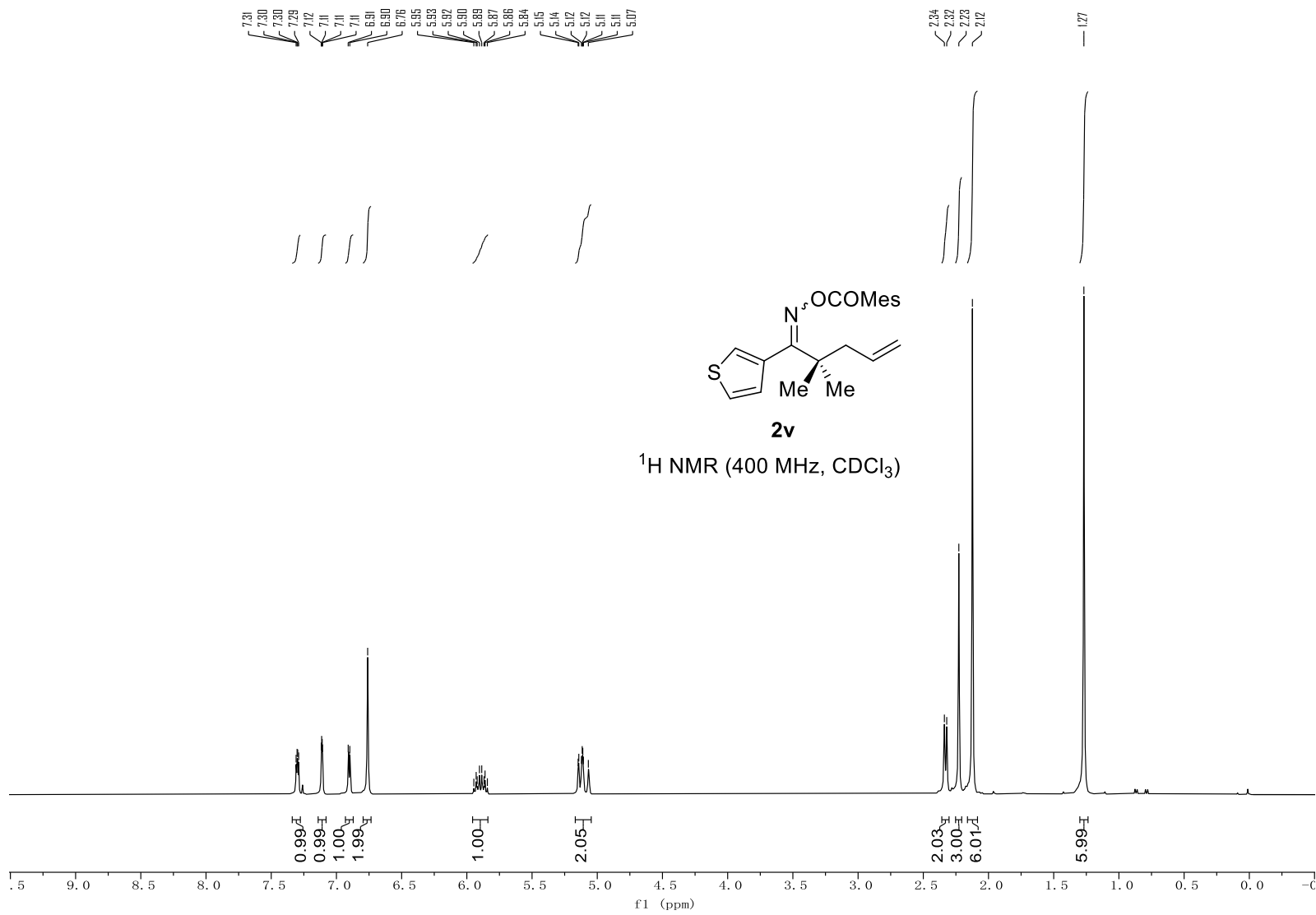


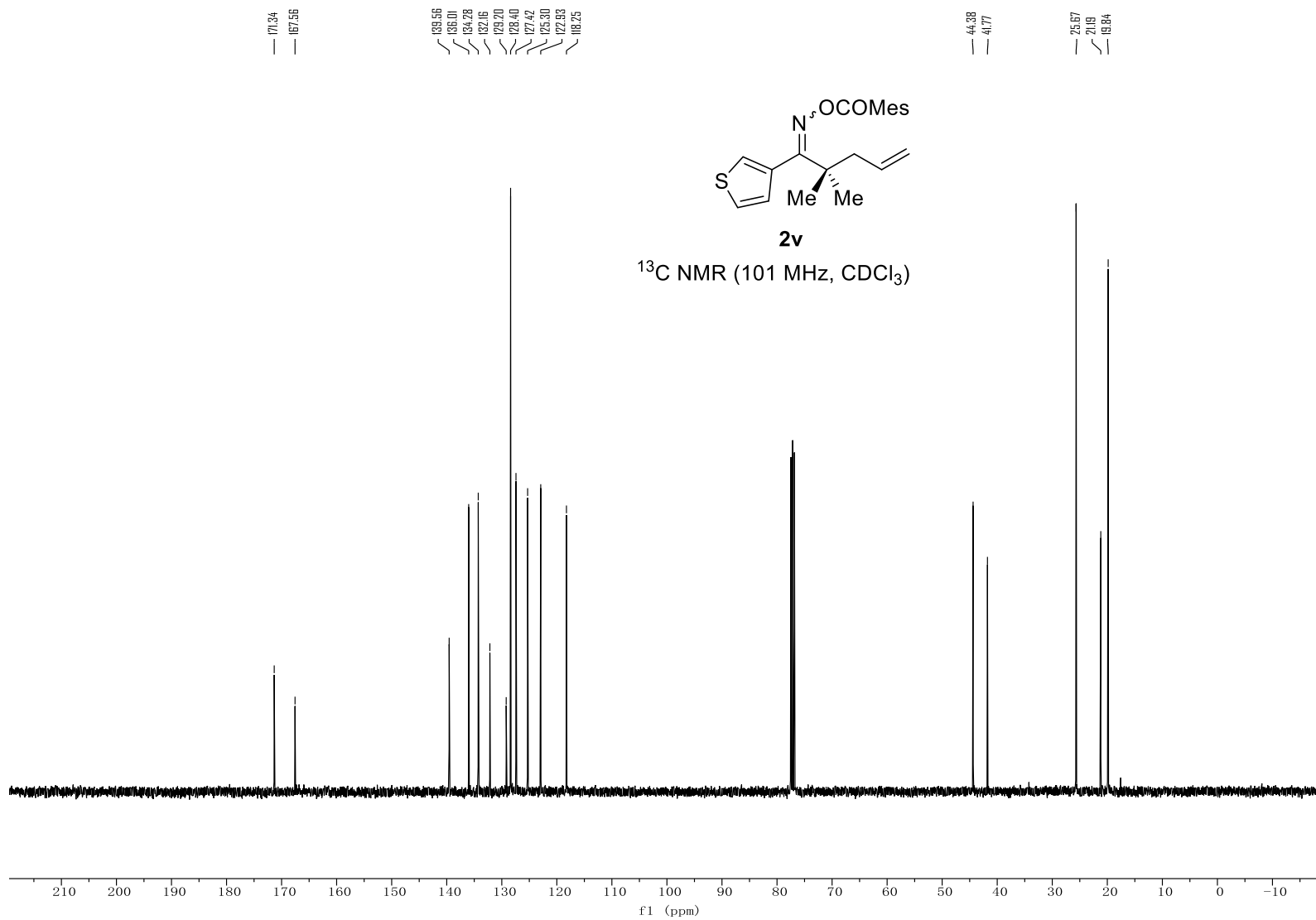


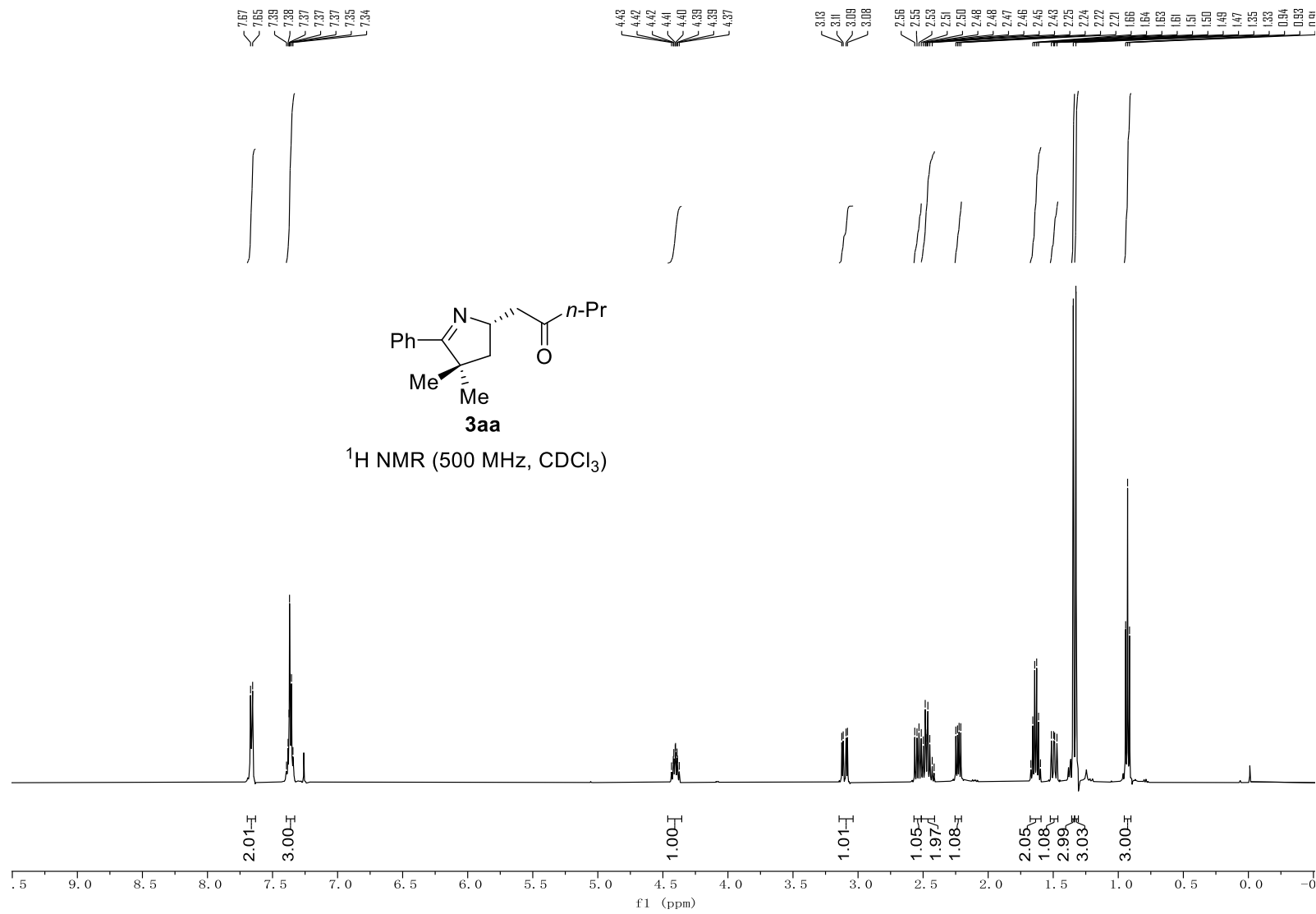
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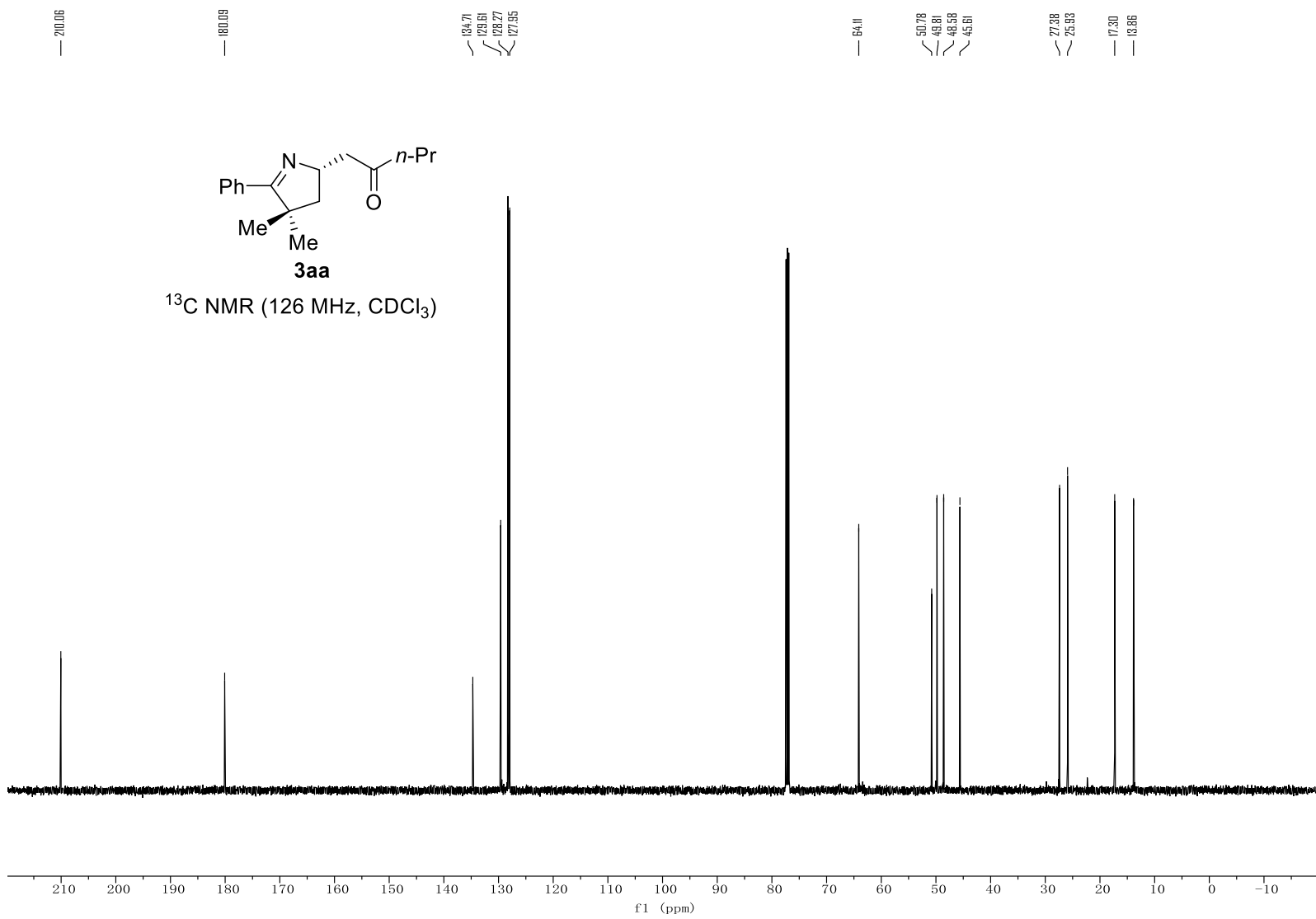
¹⁹F NMR (376 MHz, CDCl₃)

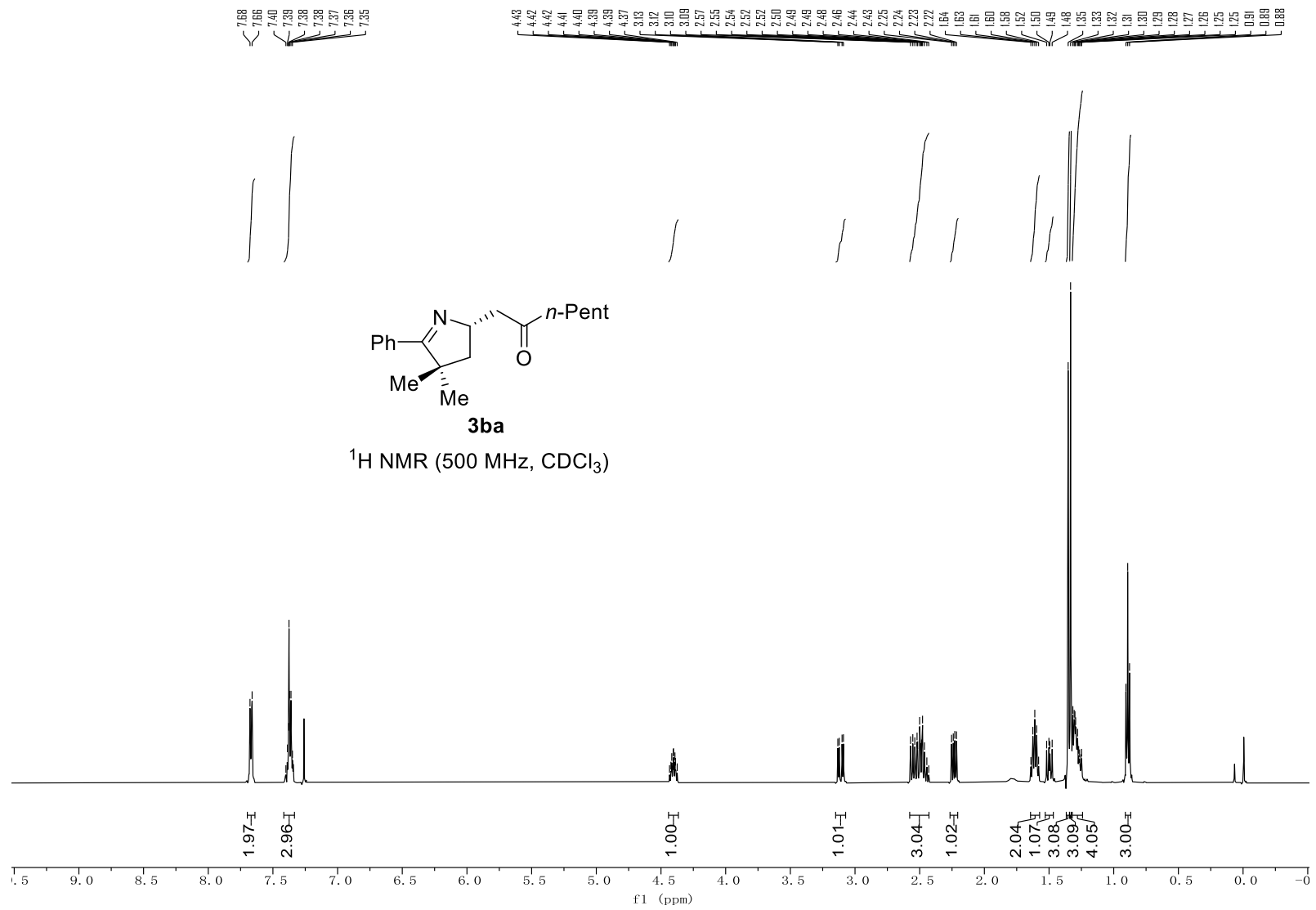


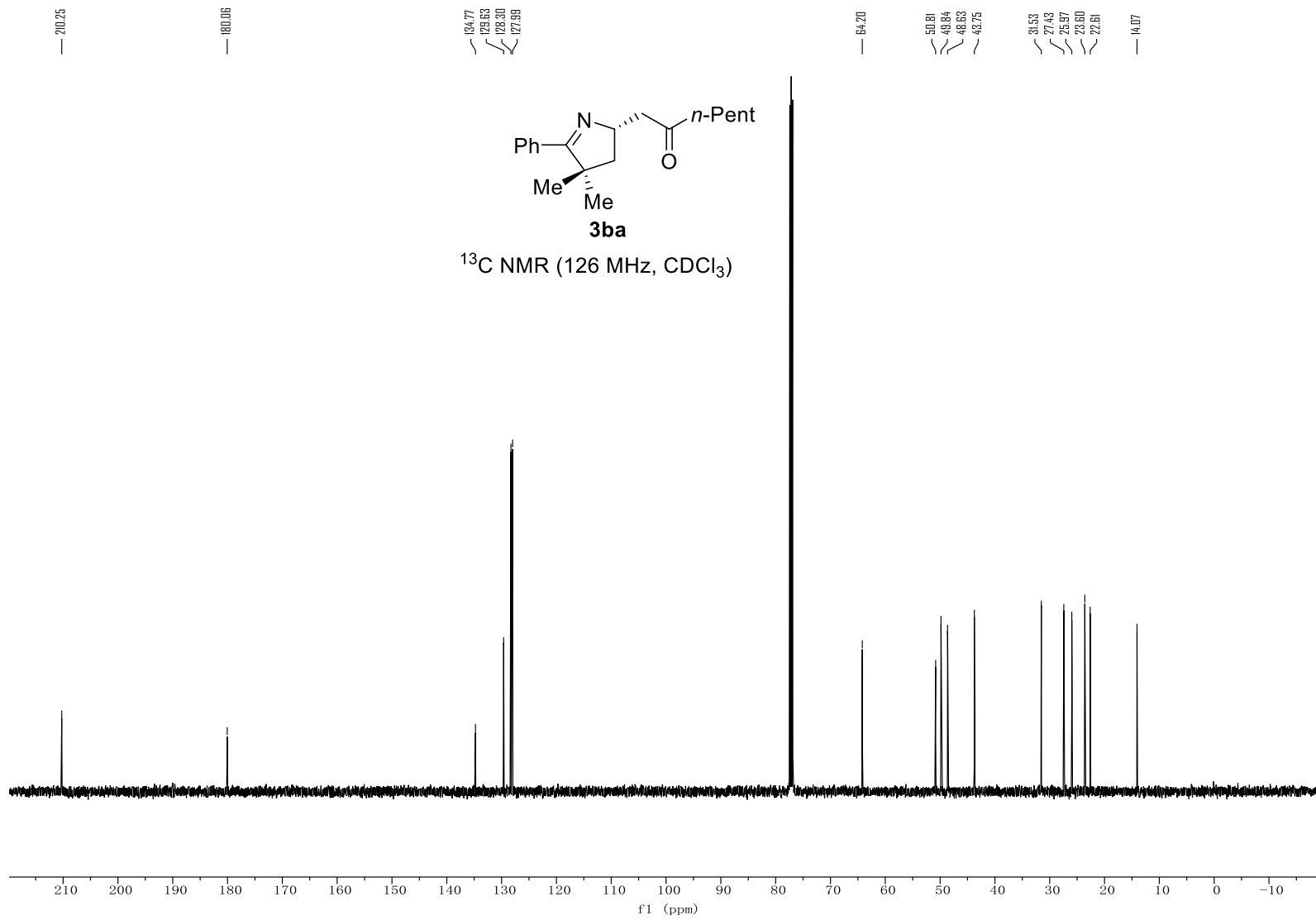


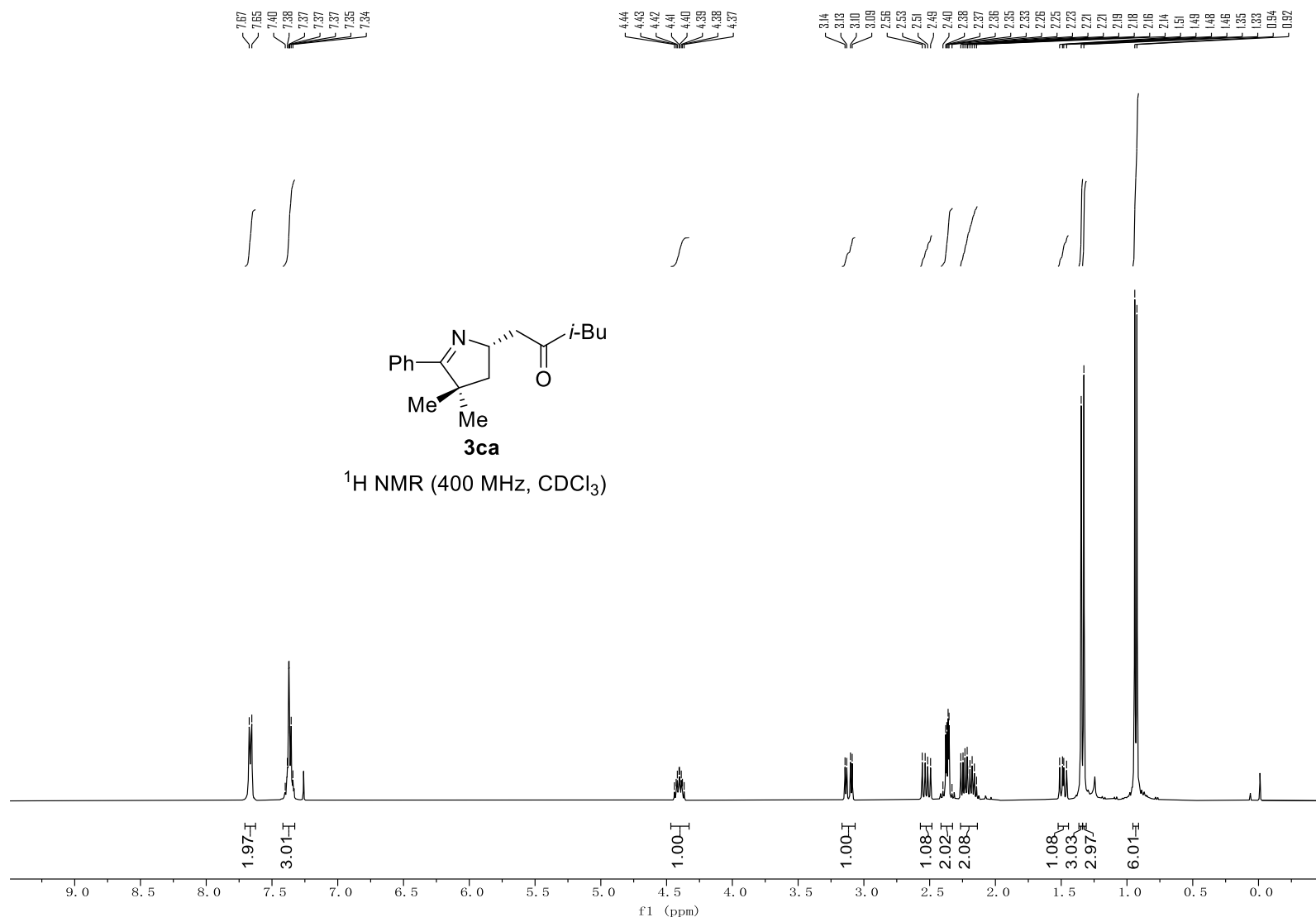


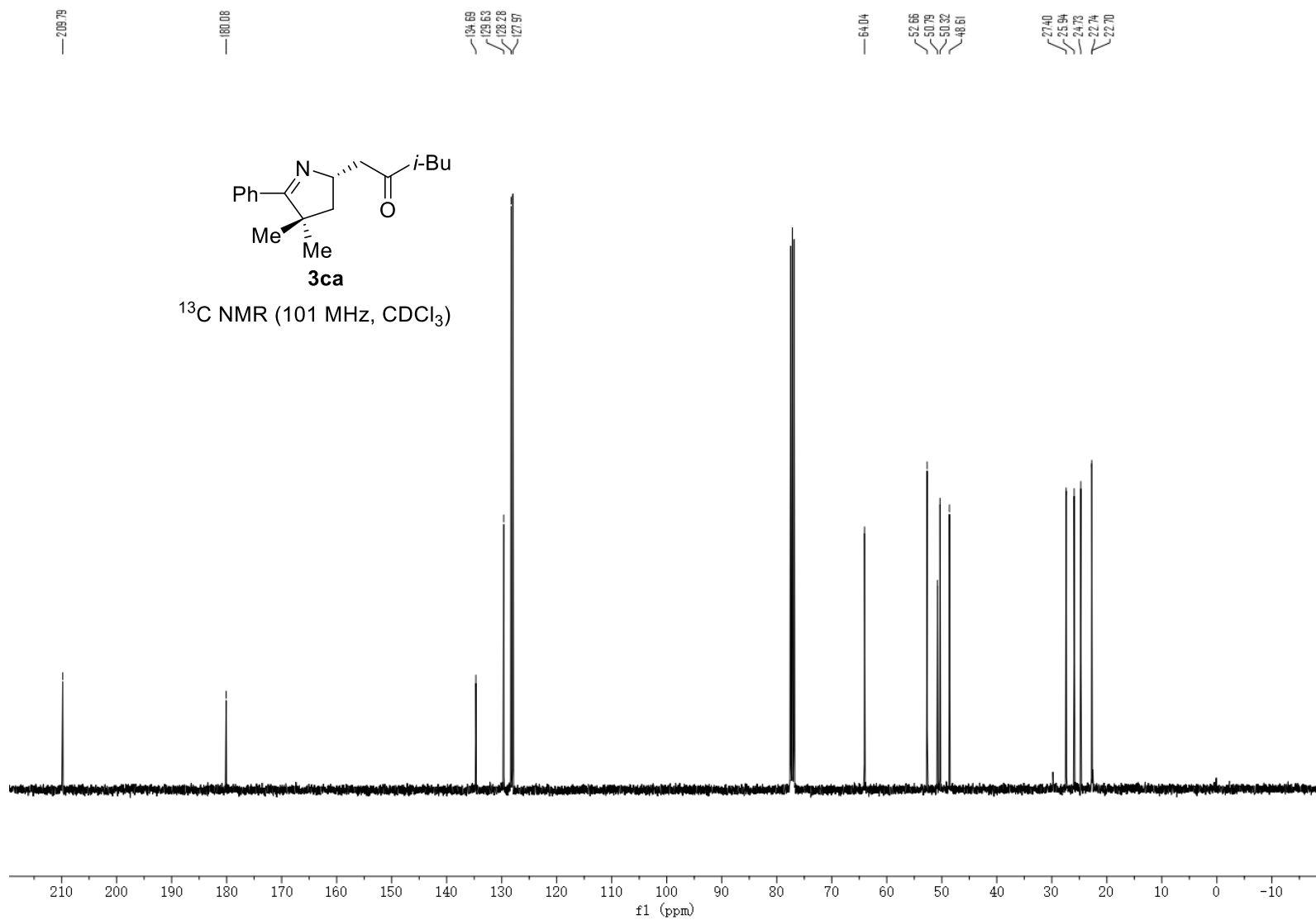


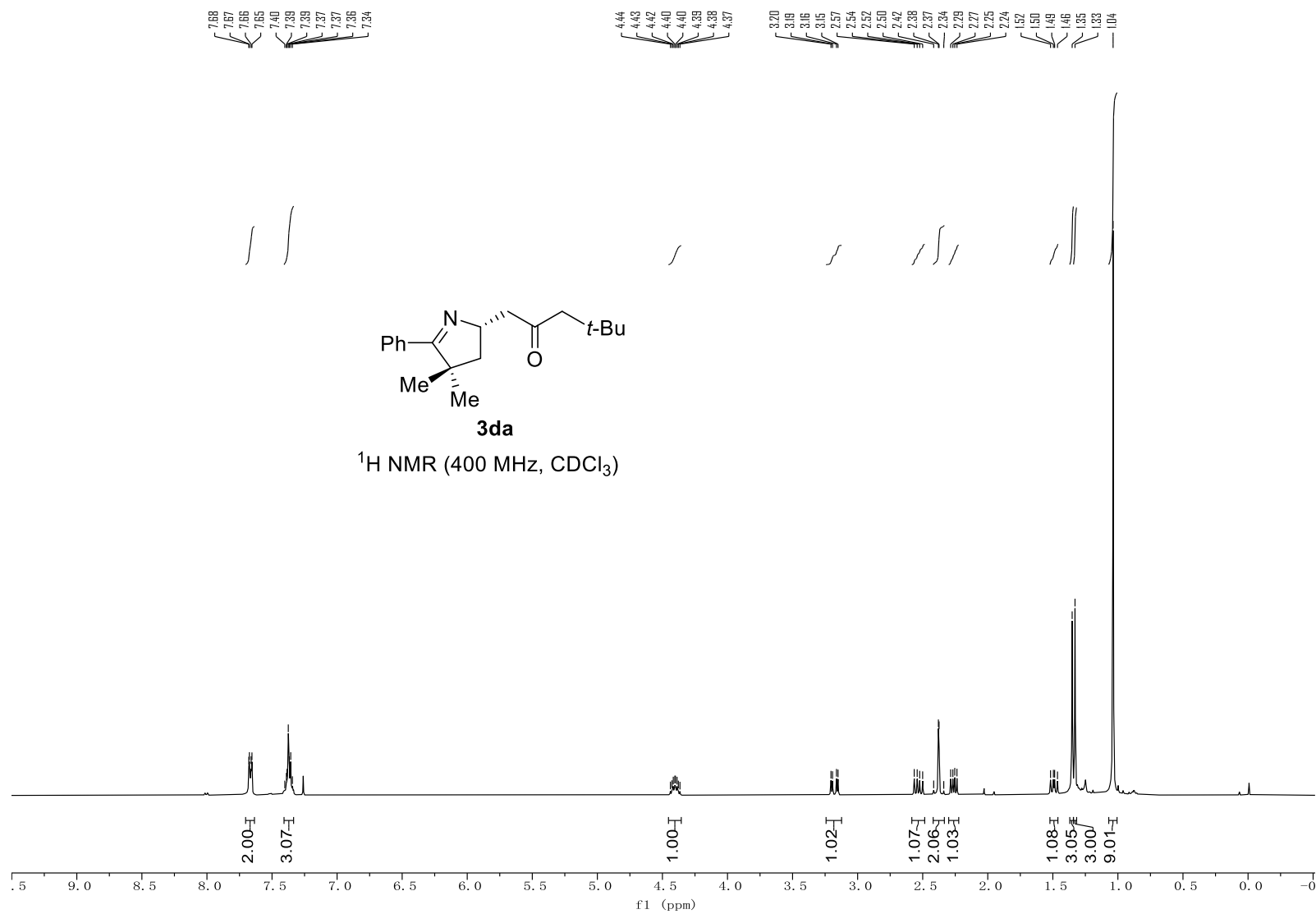


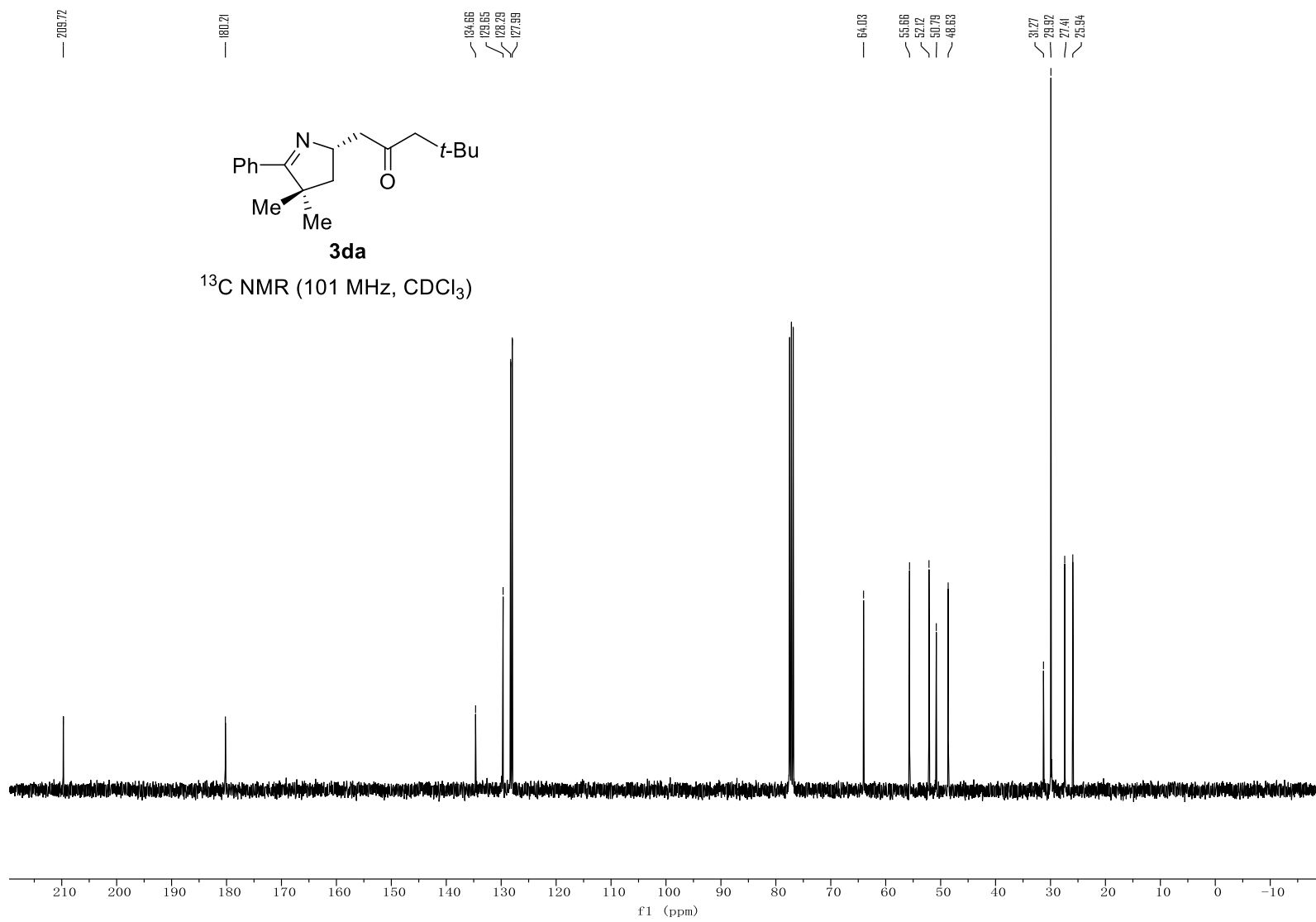


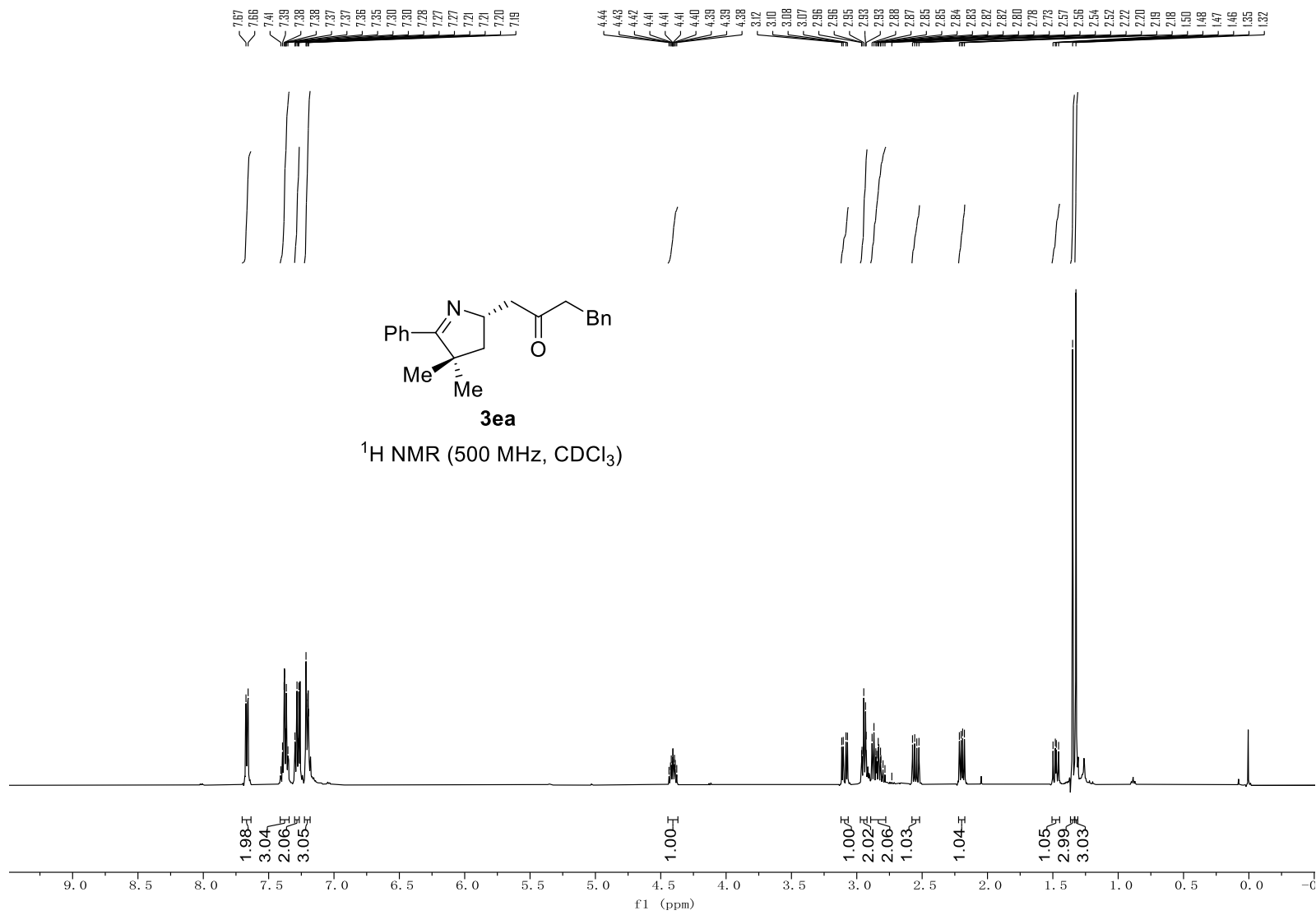


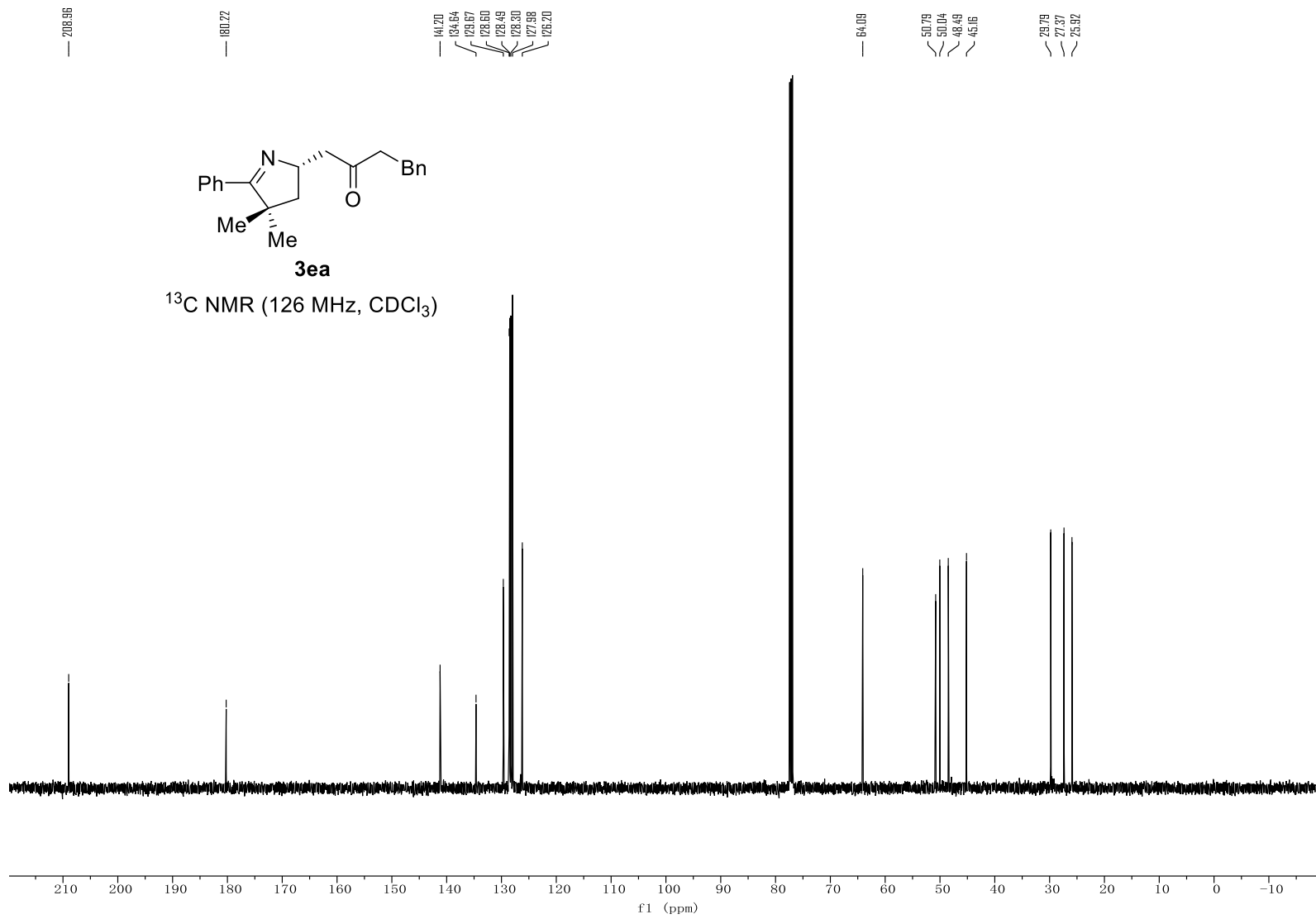


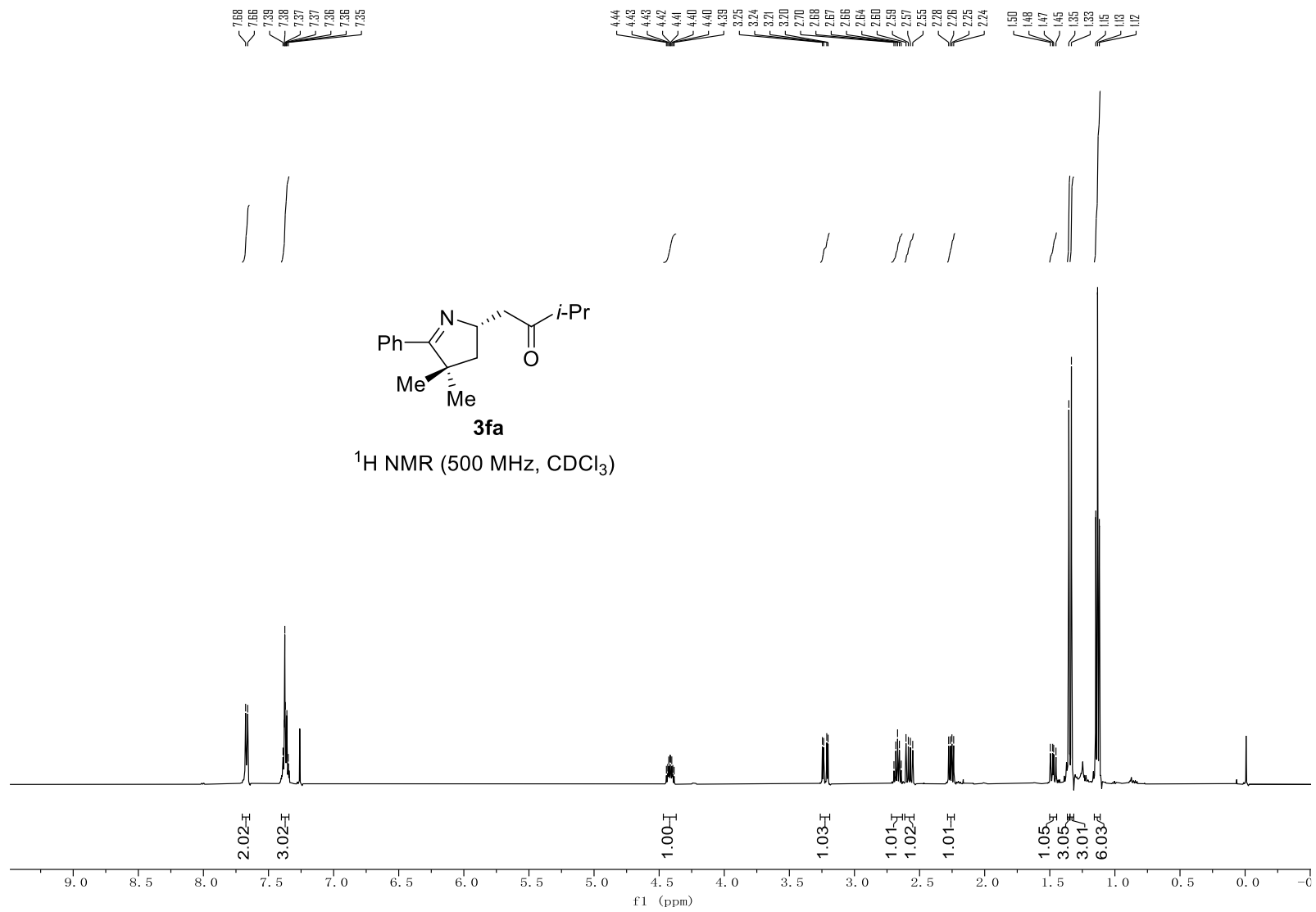


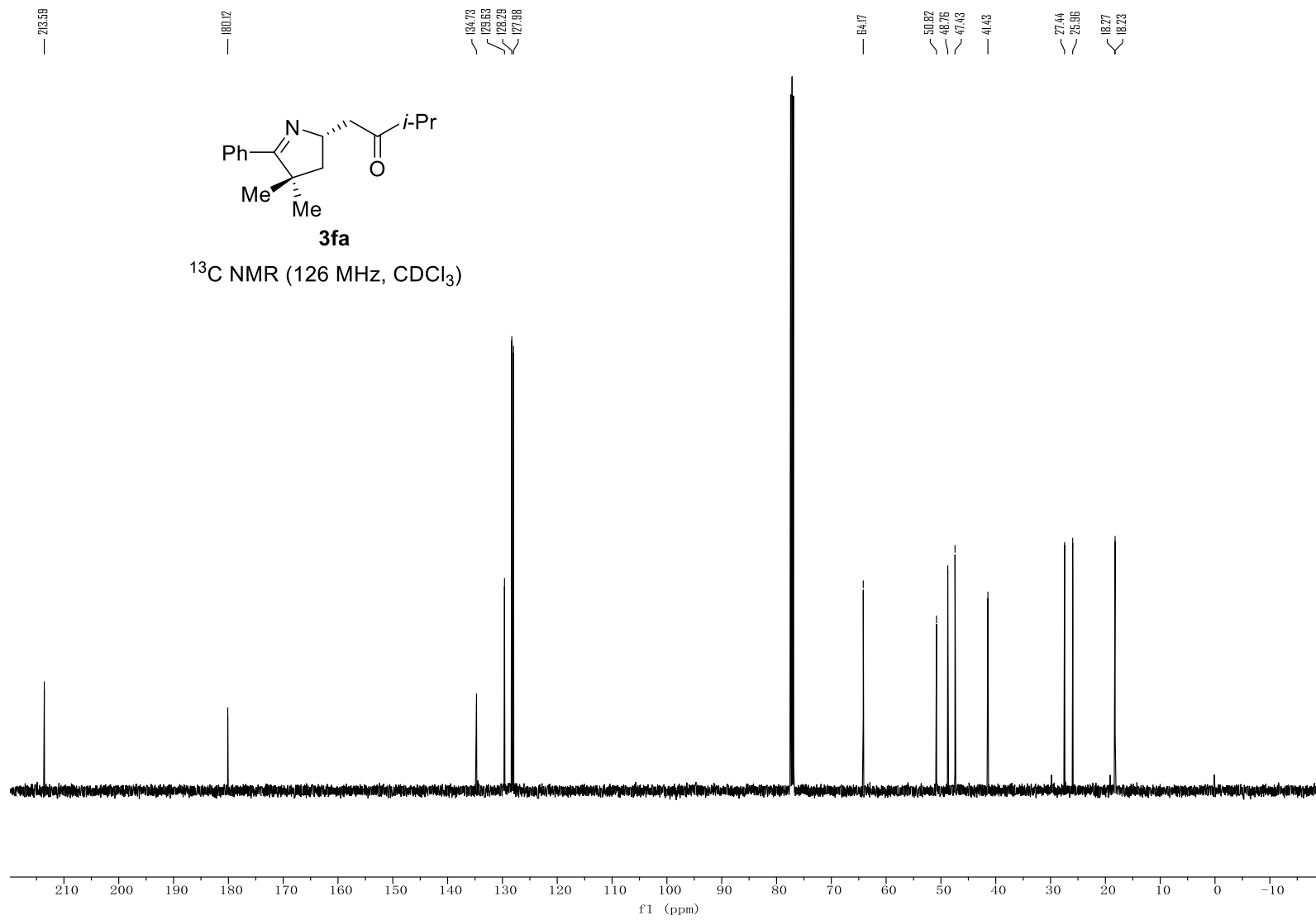


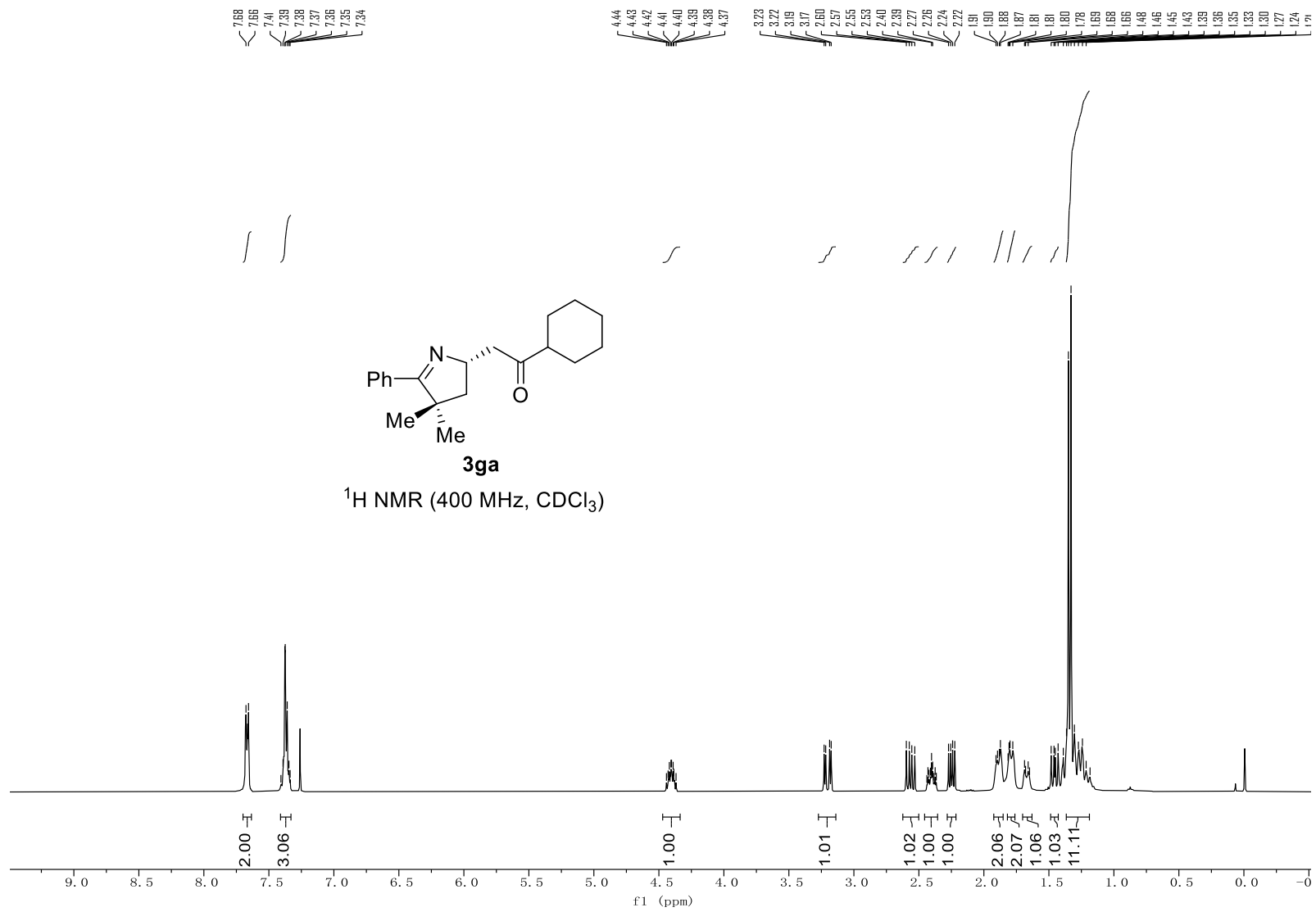


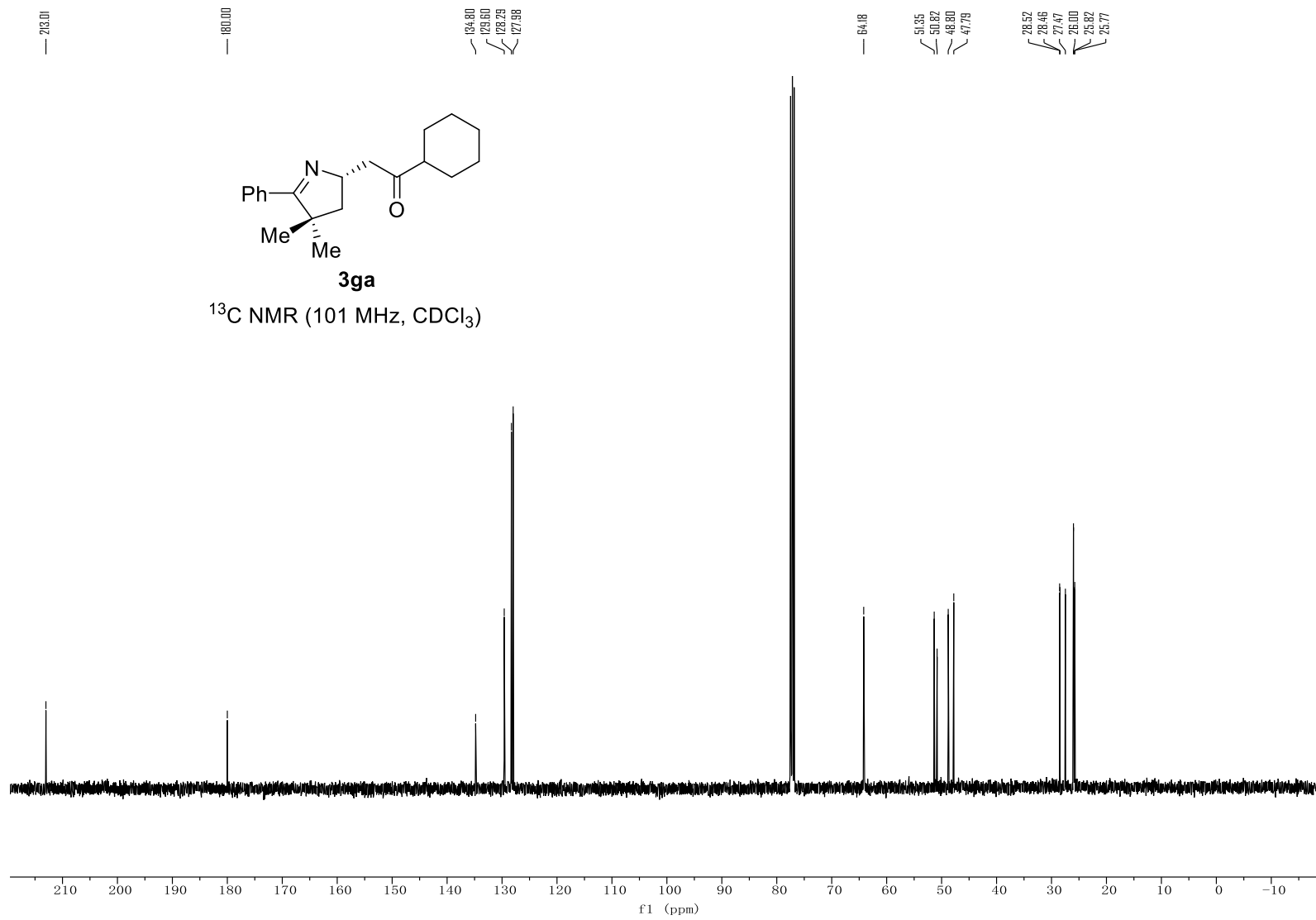


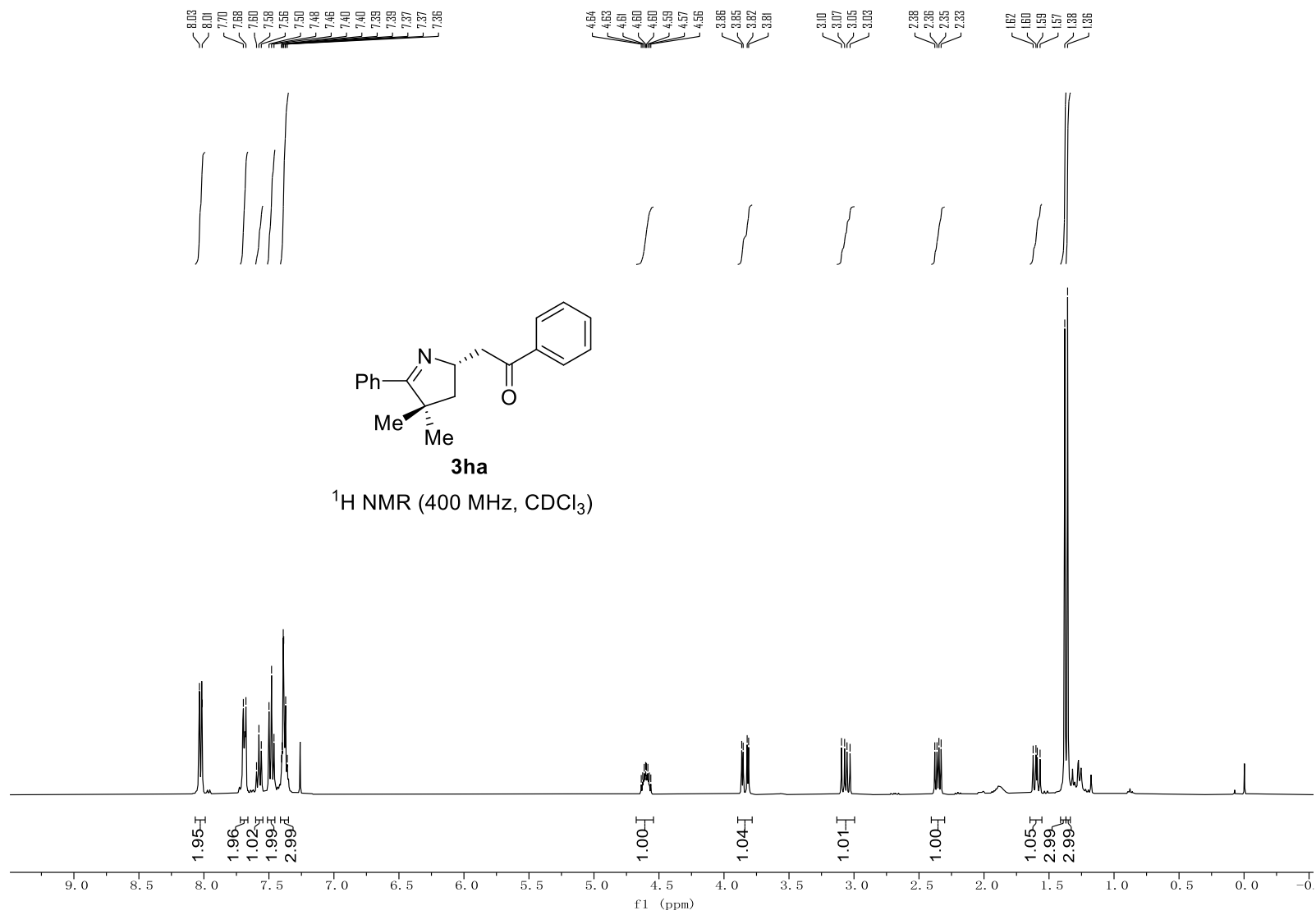


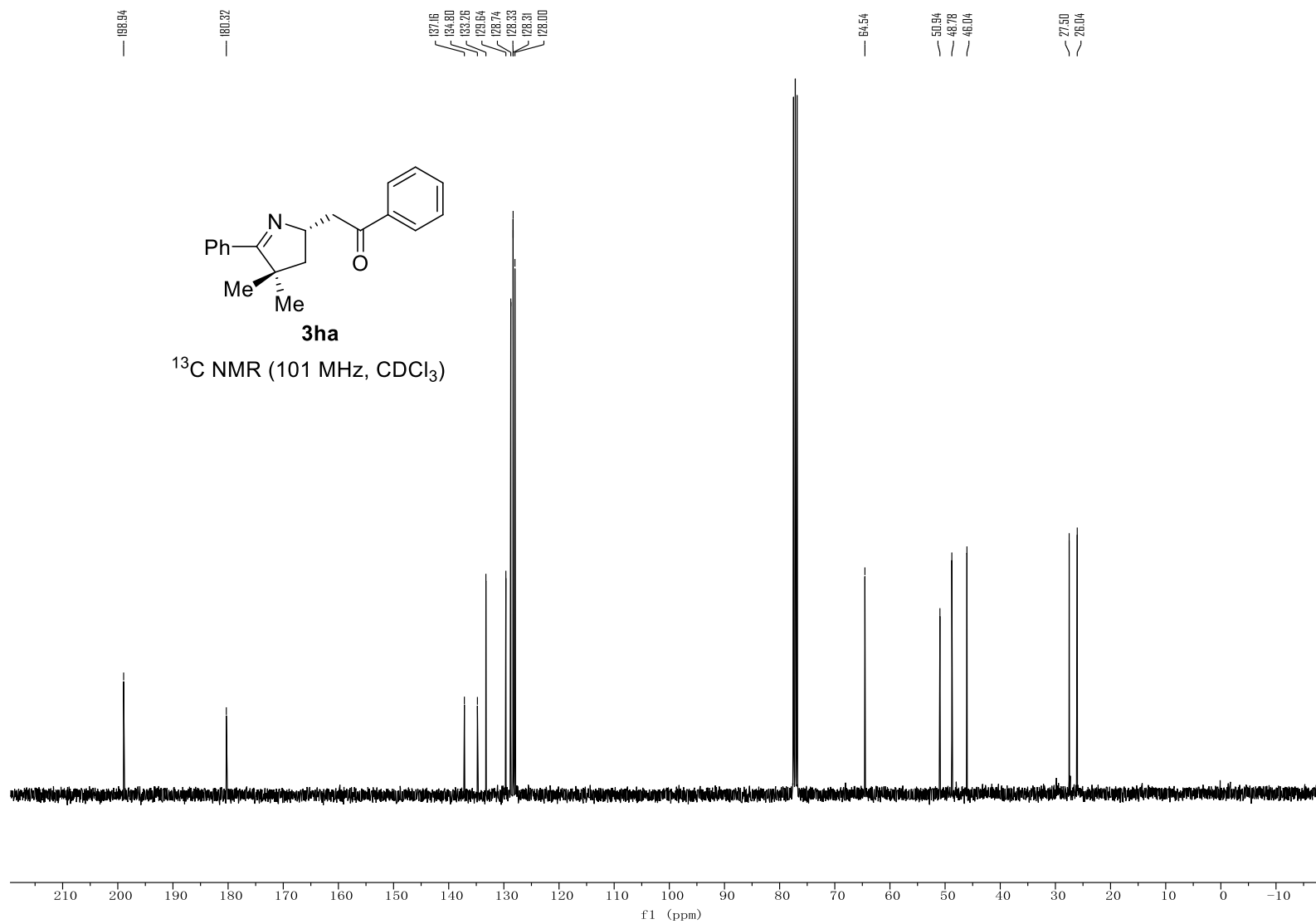


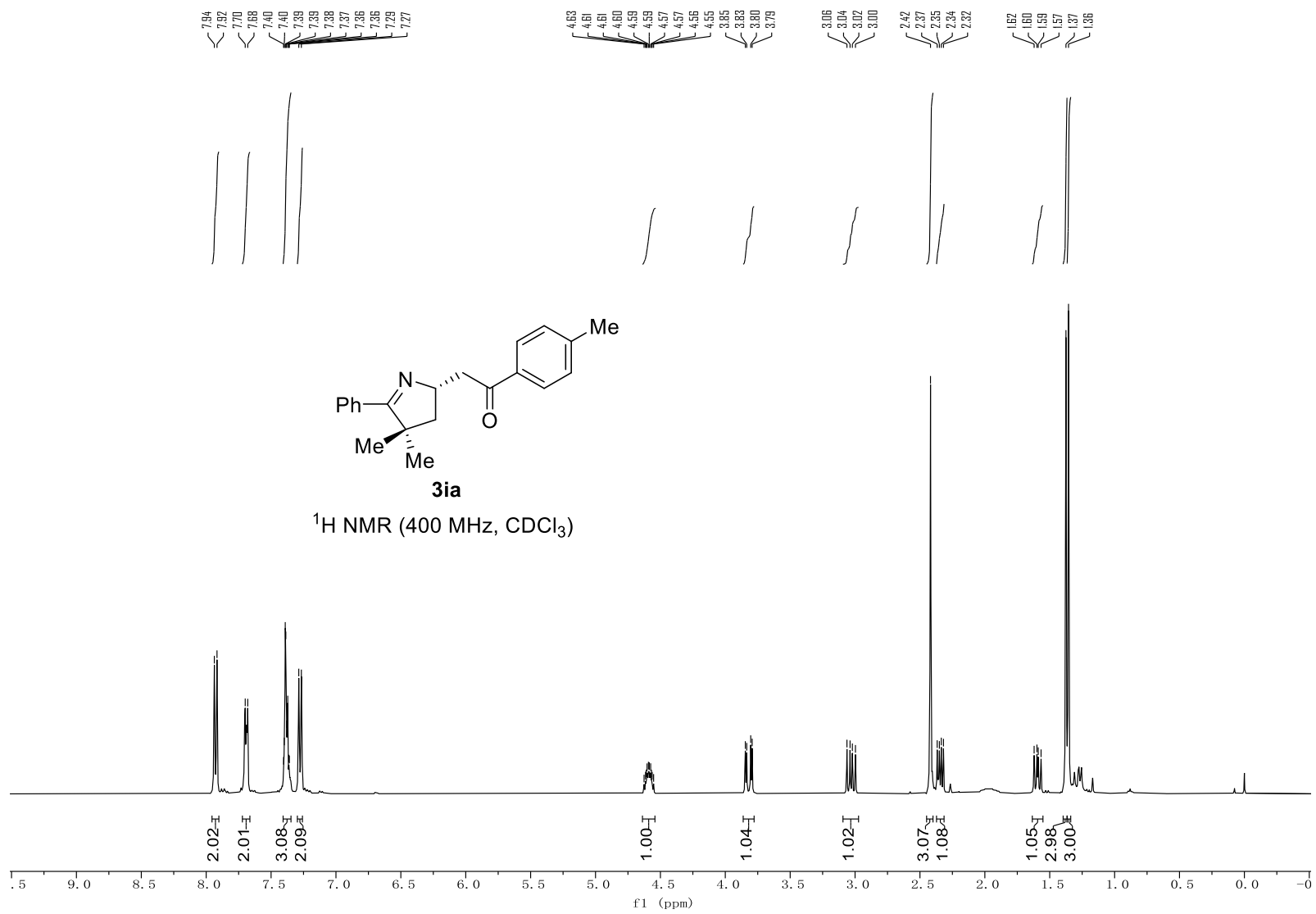


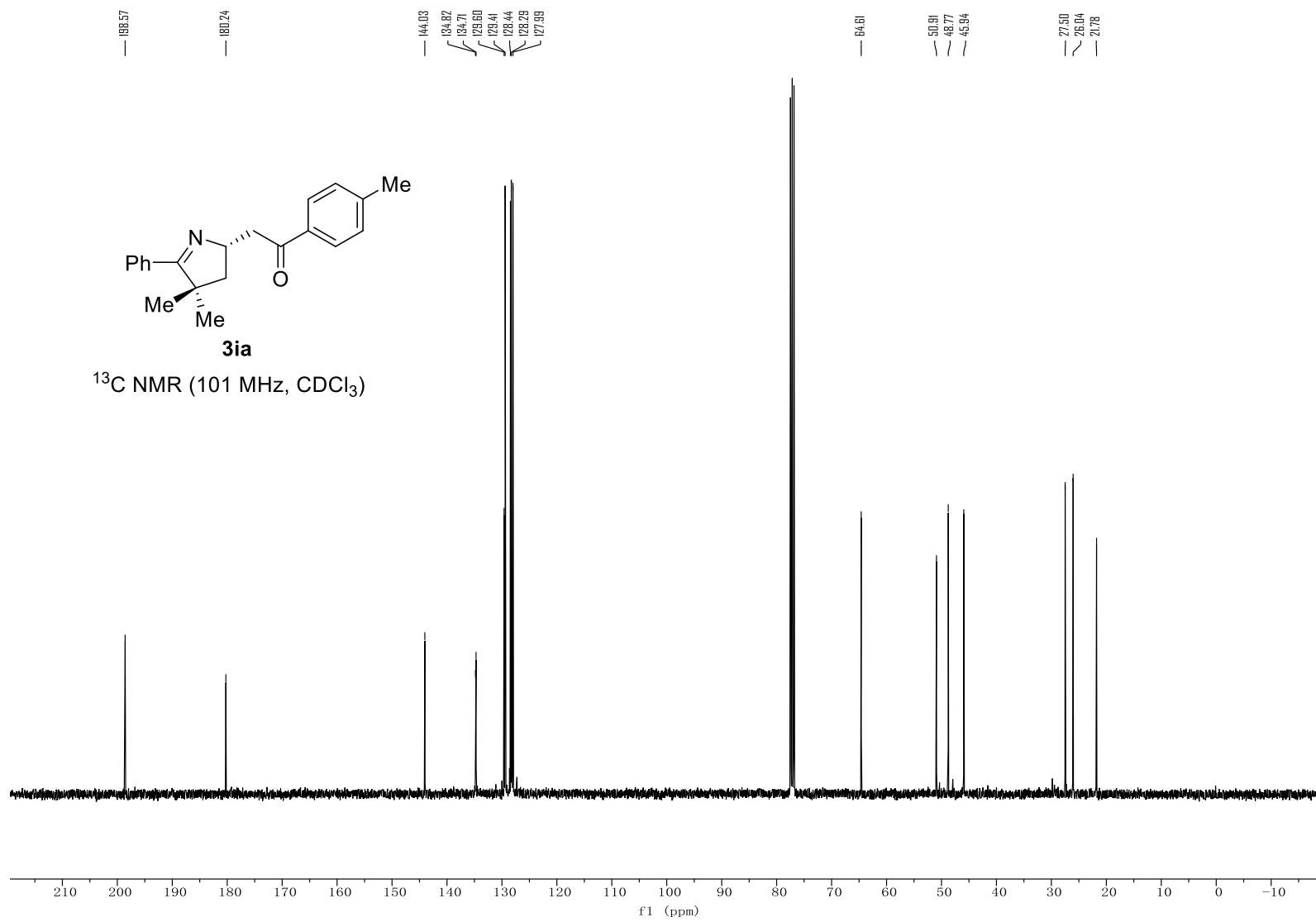


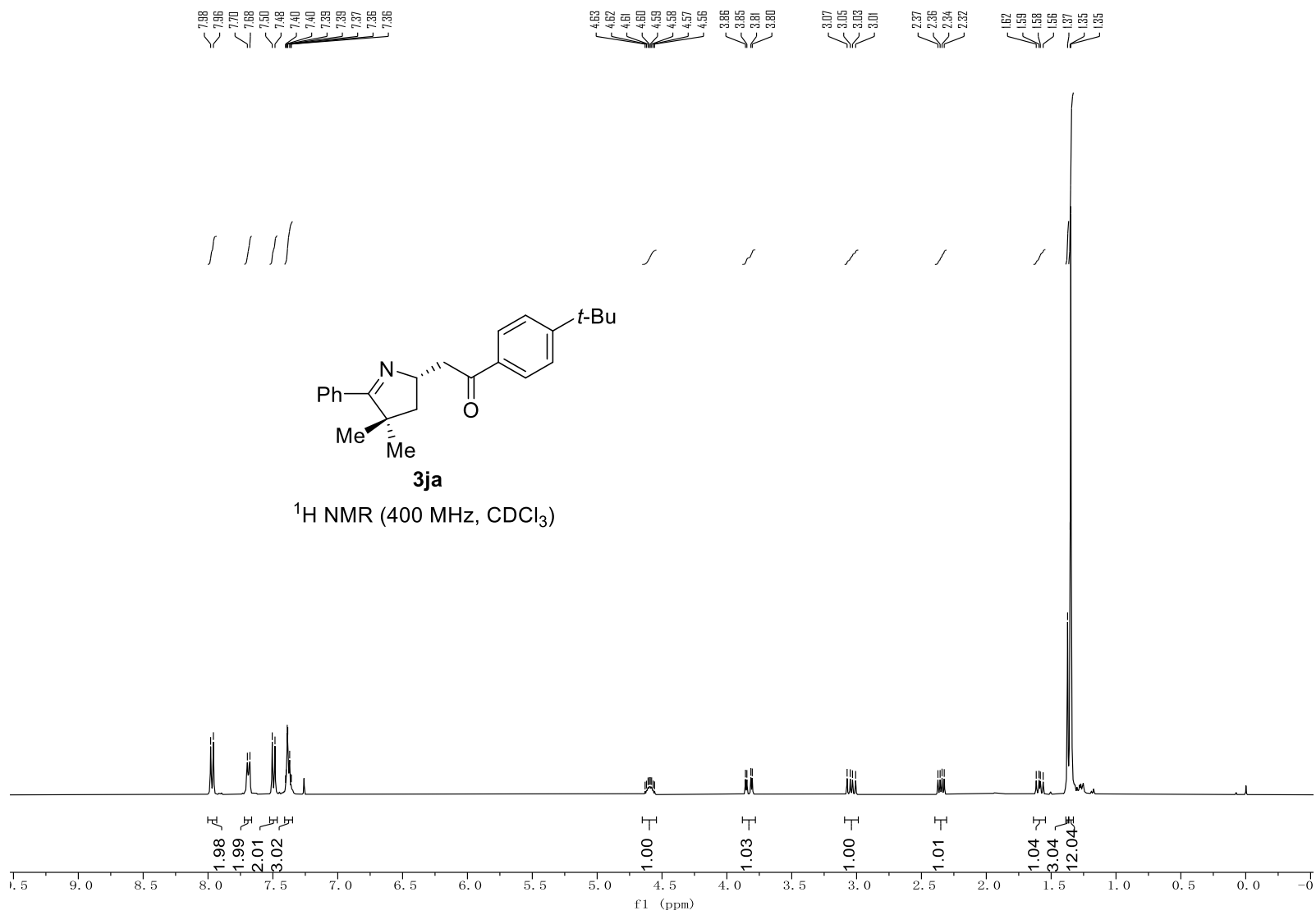


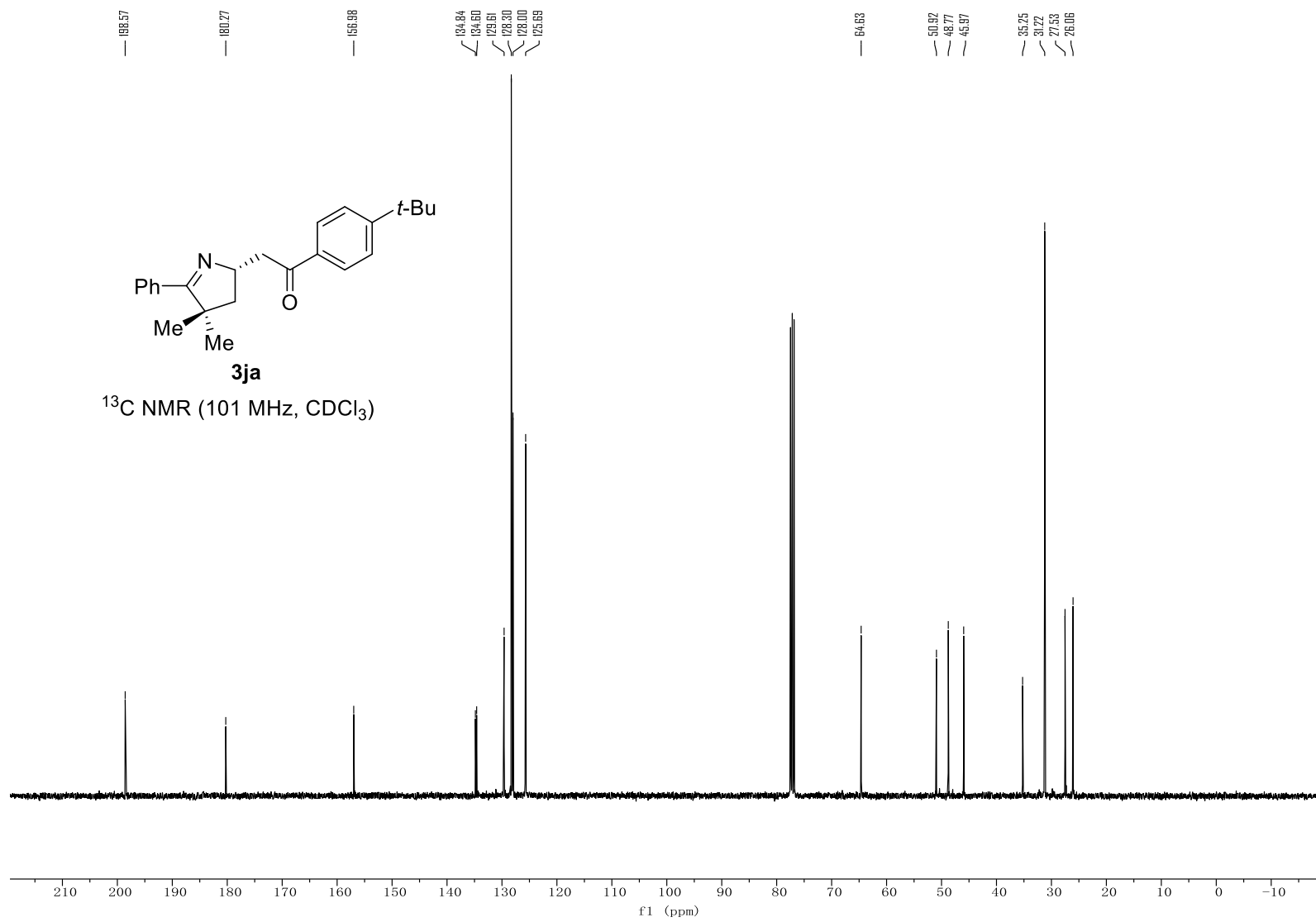


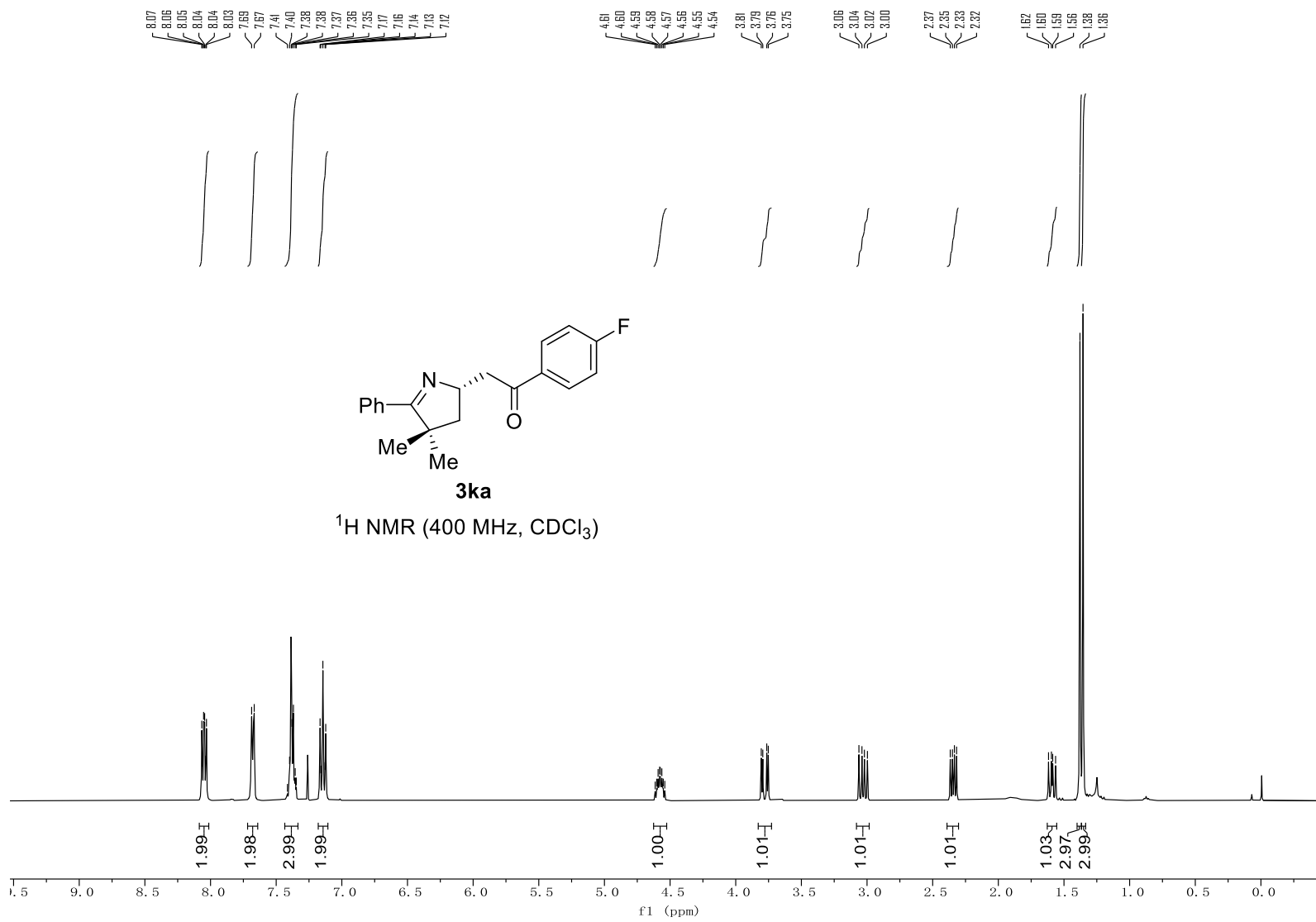






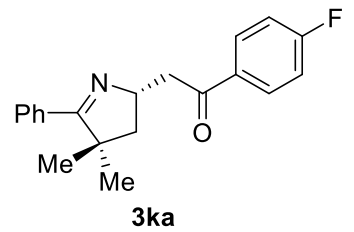




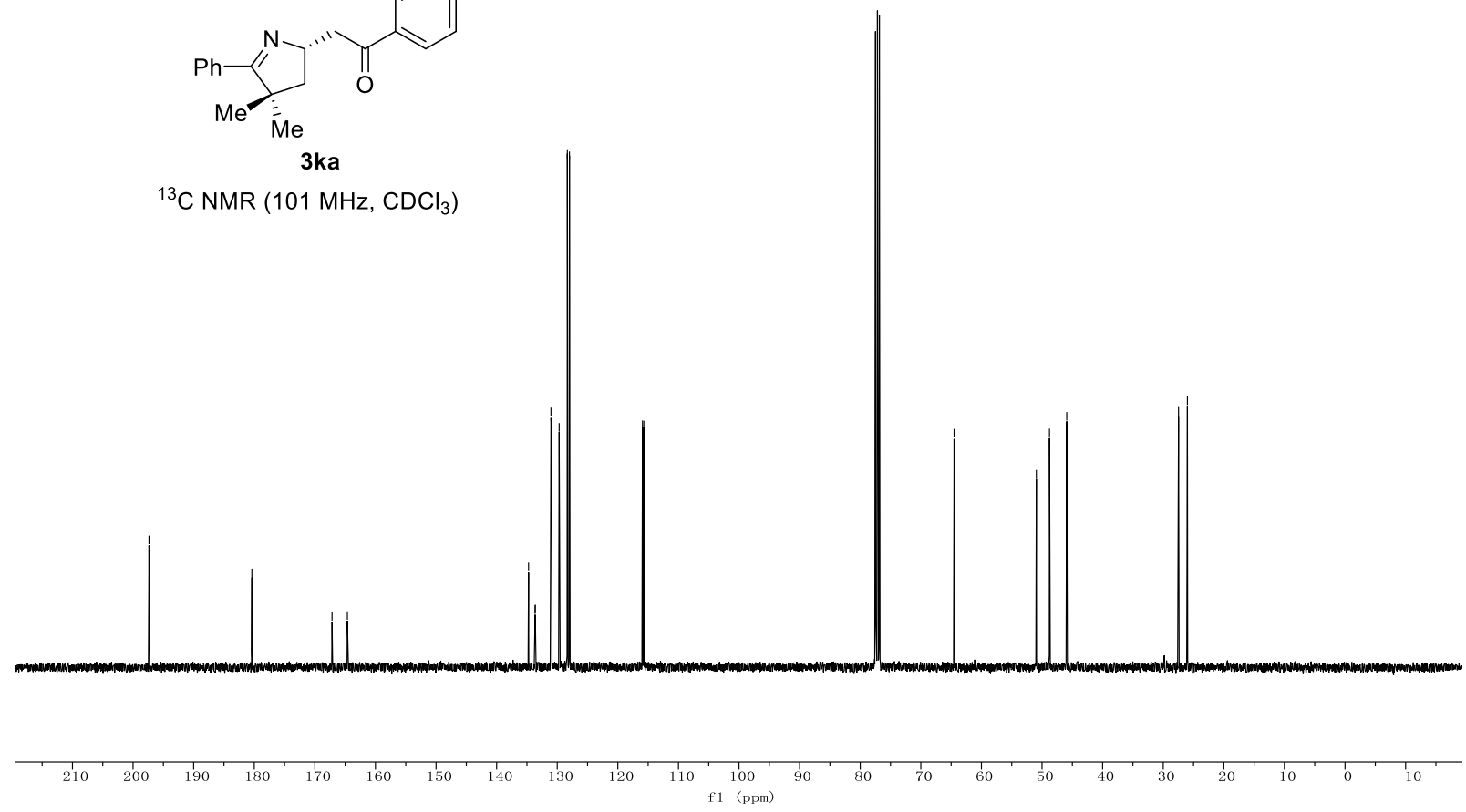


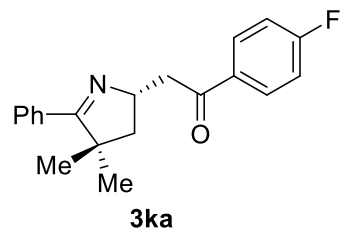
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164.63
134.73
133.65
133.62
131.04
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128.33
127.98
115.93
115.71

64.51
50.94
48.77
45.92
27.47
26.01

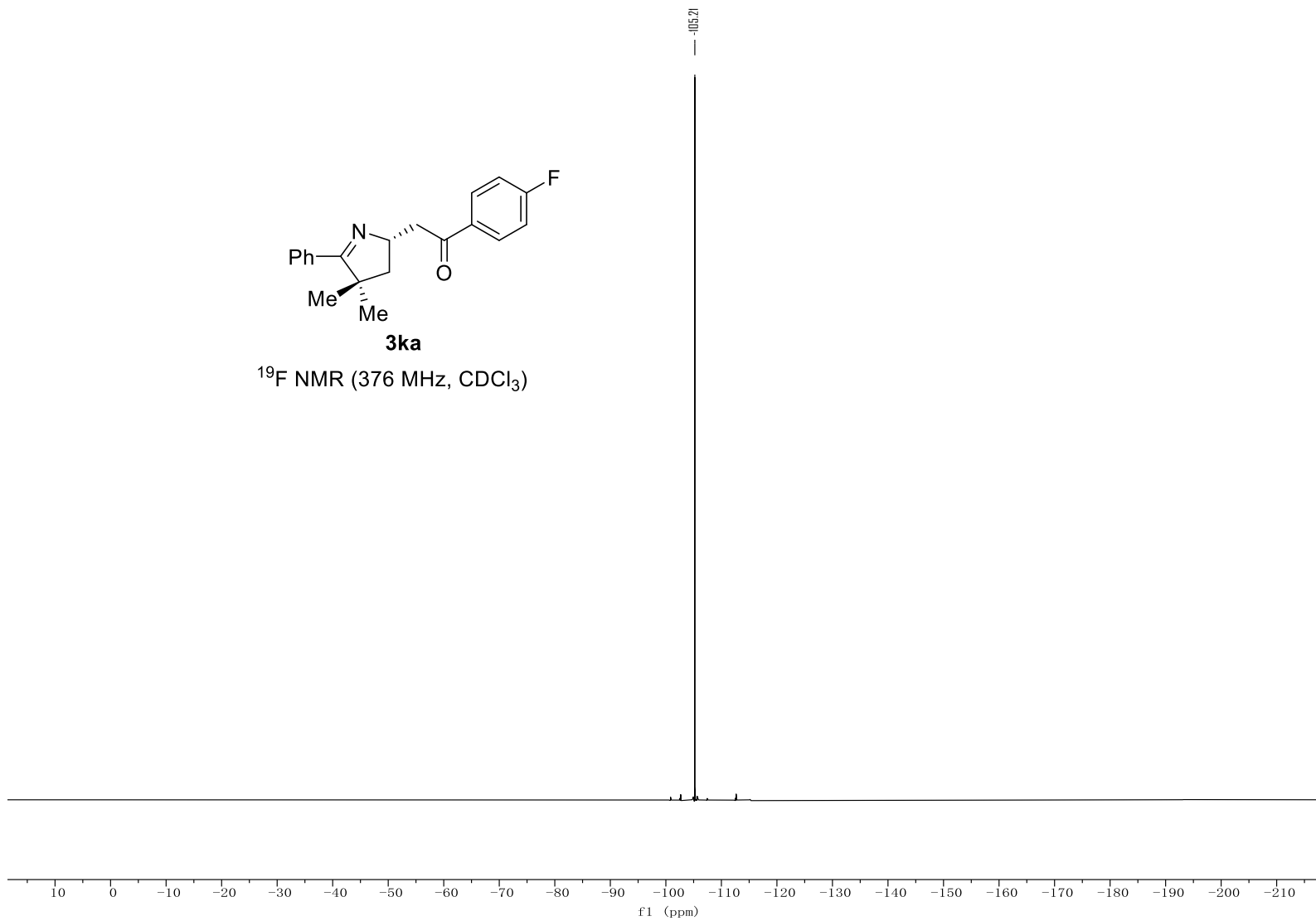


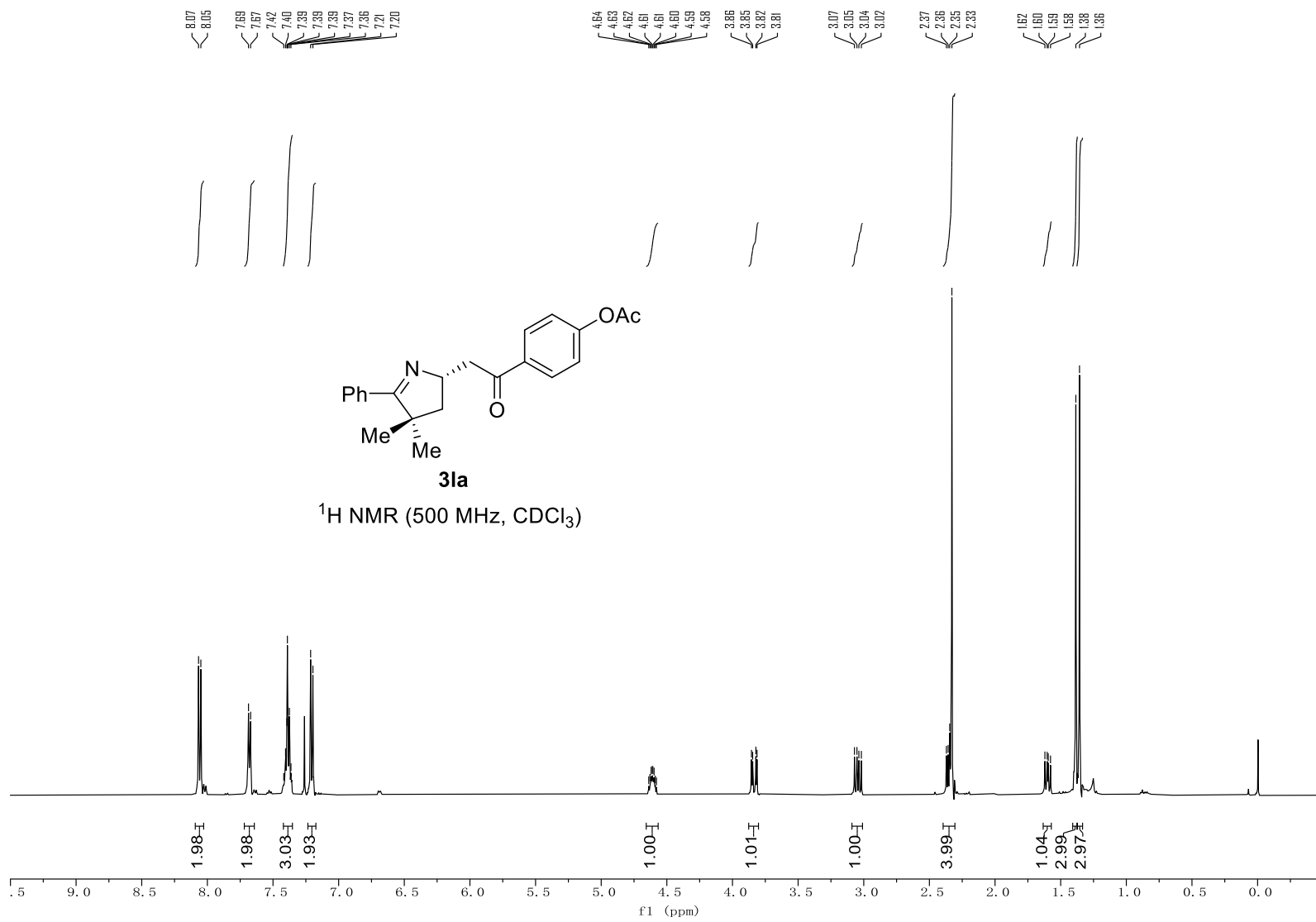
¹³C NMR (101 MHz, CDCl₃)

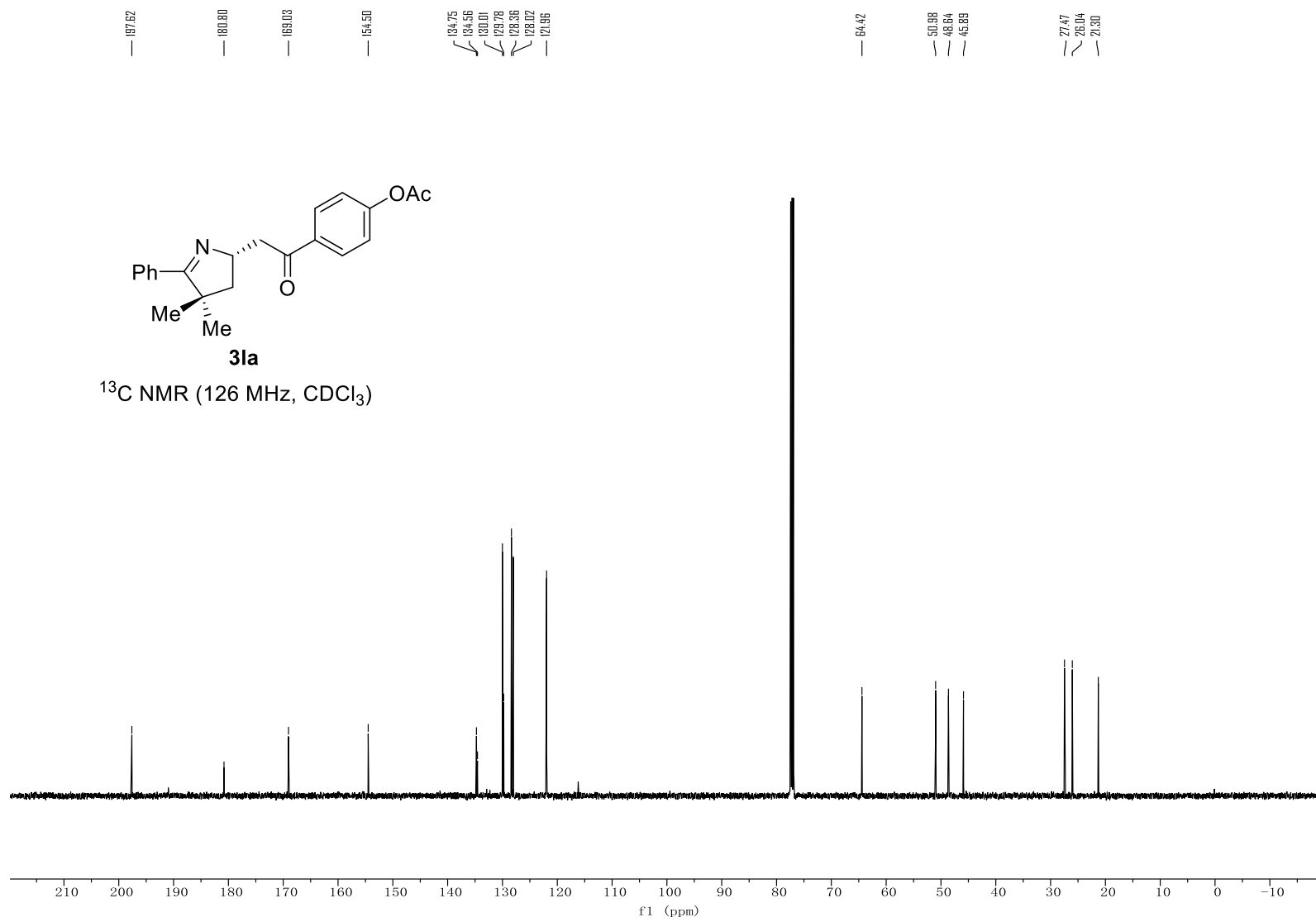


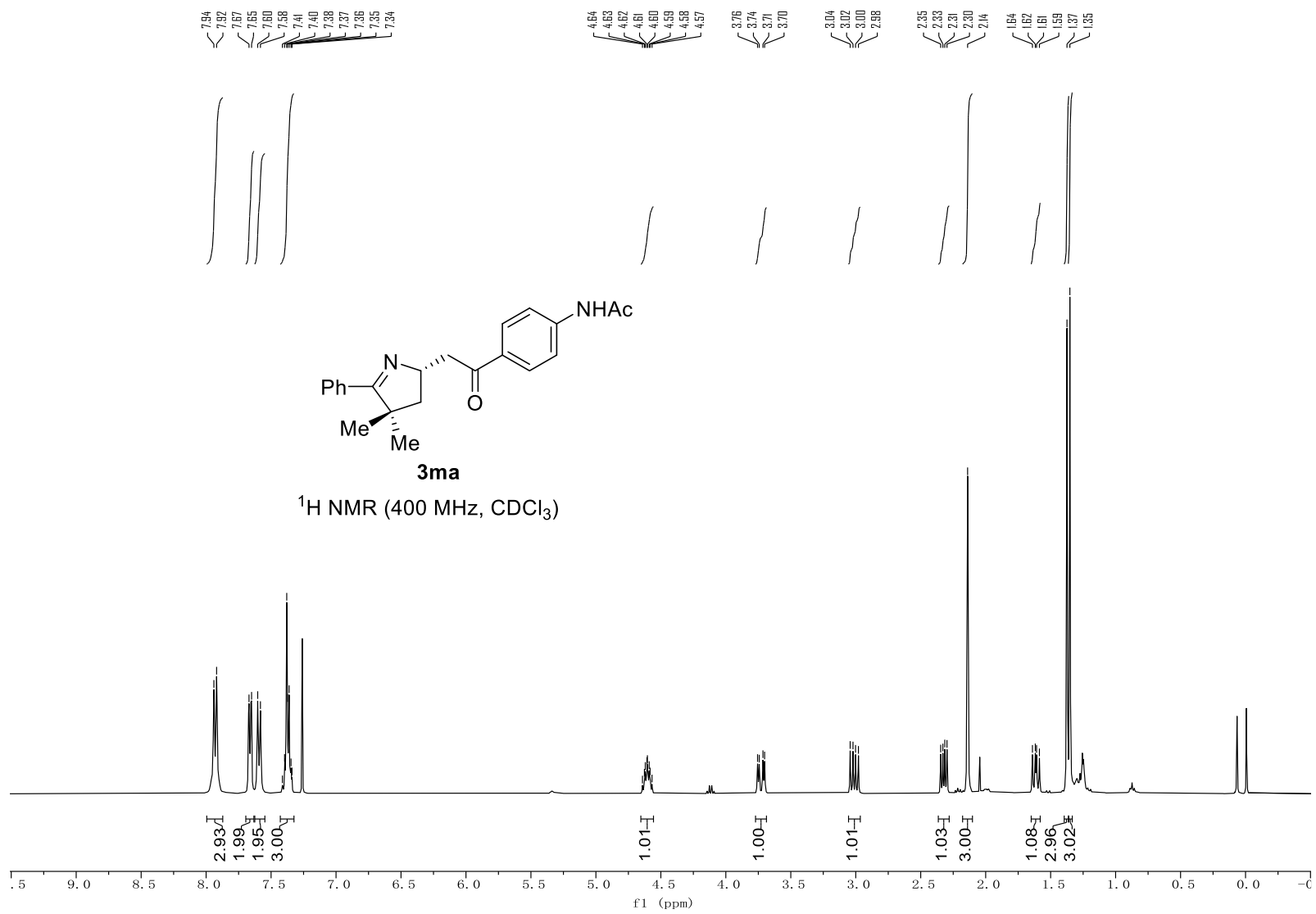


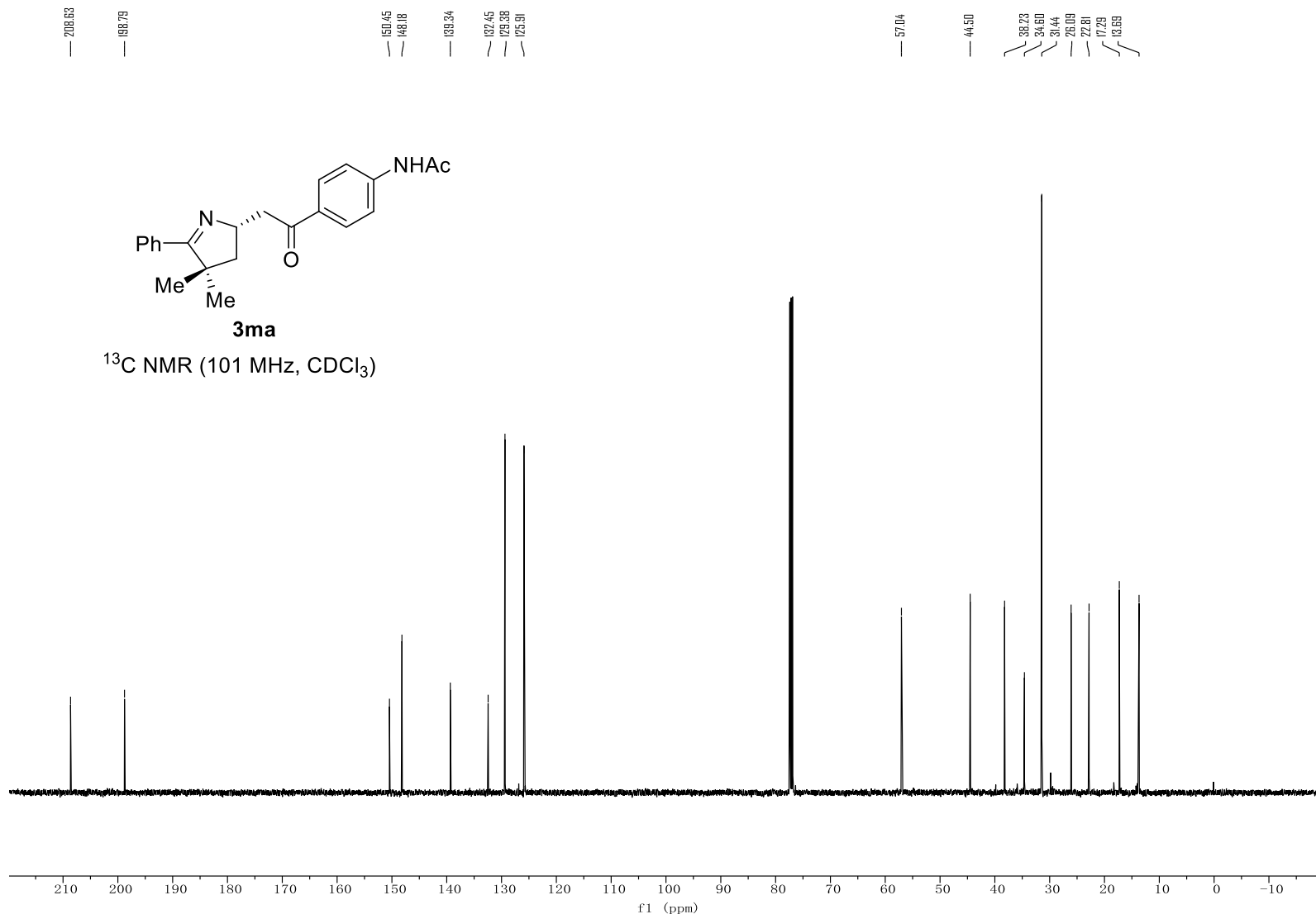
^{19}F NMR (376 MHz, CDCl_3)

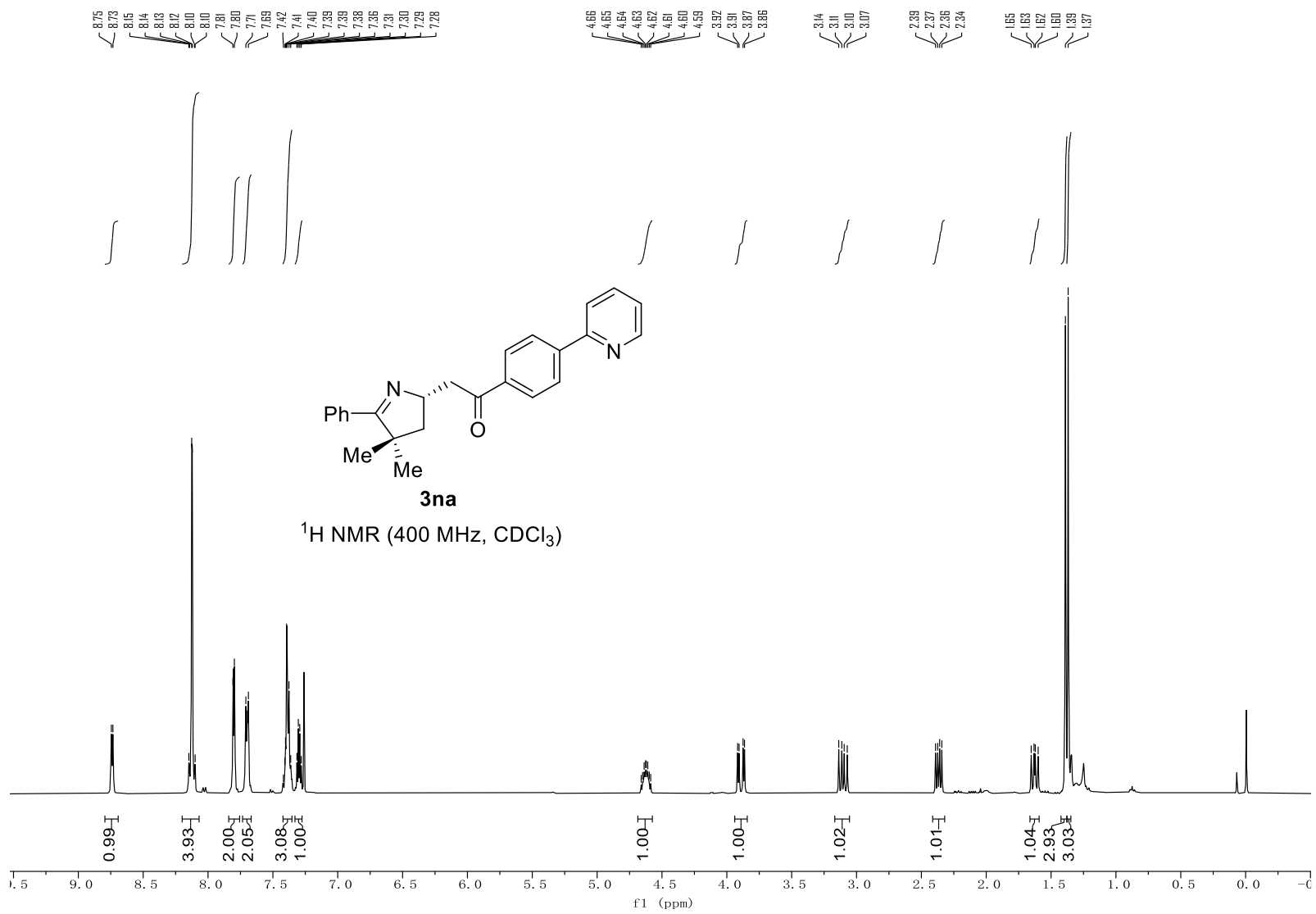


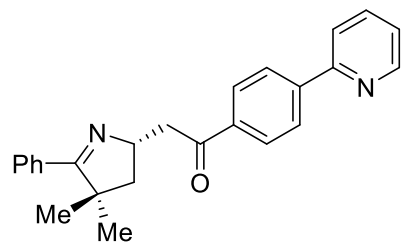






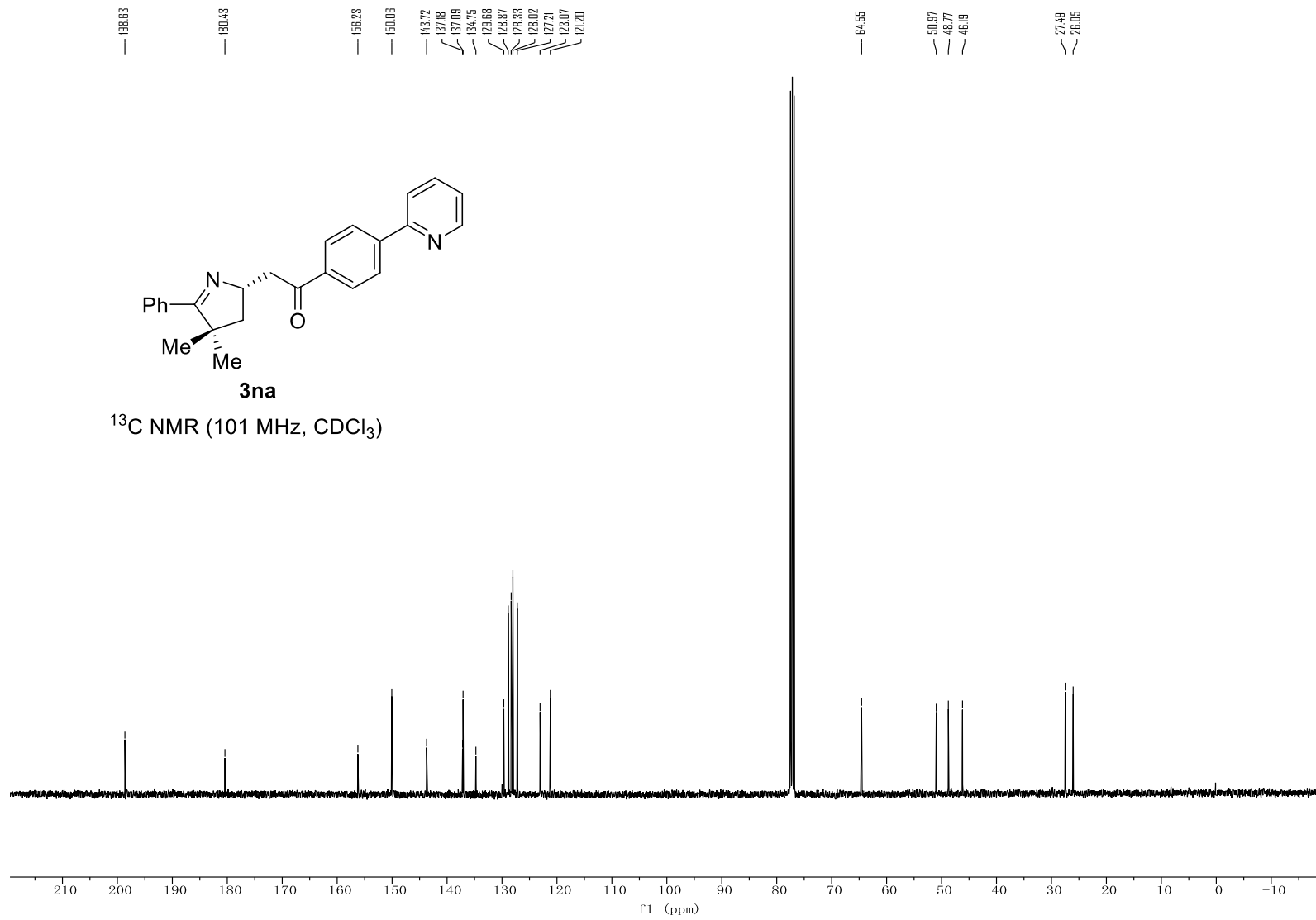


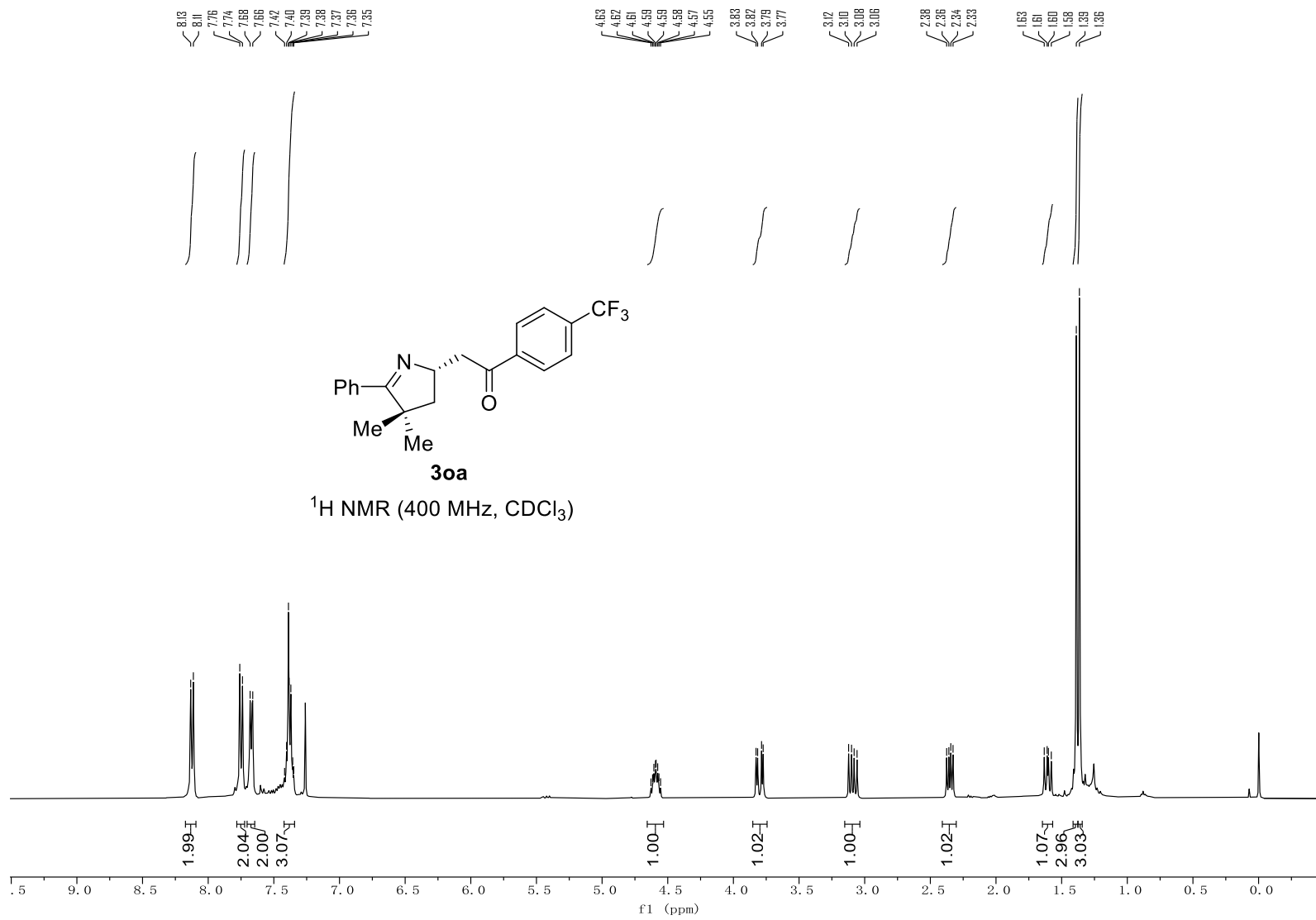


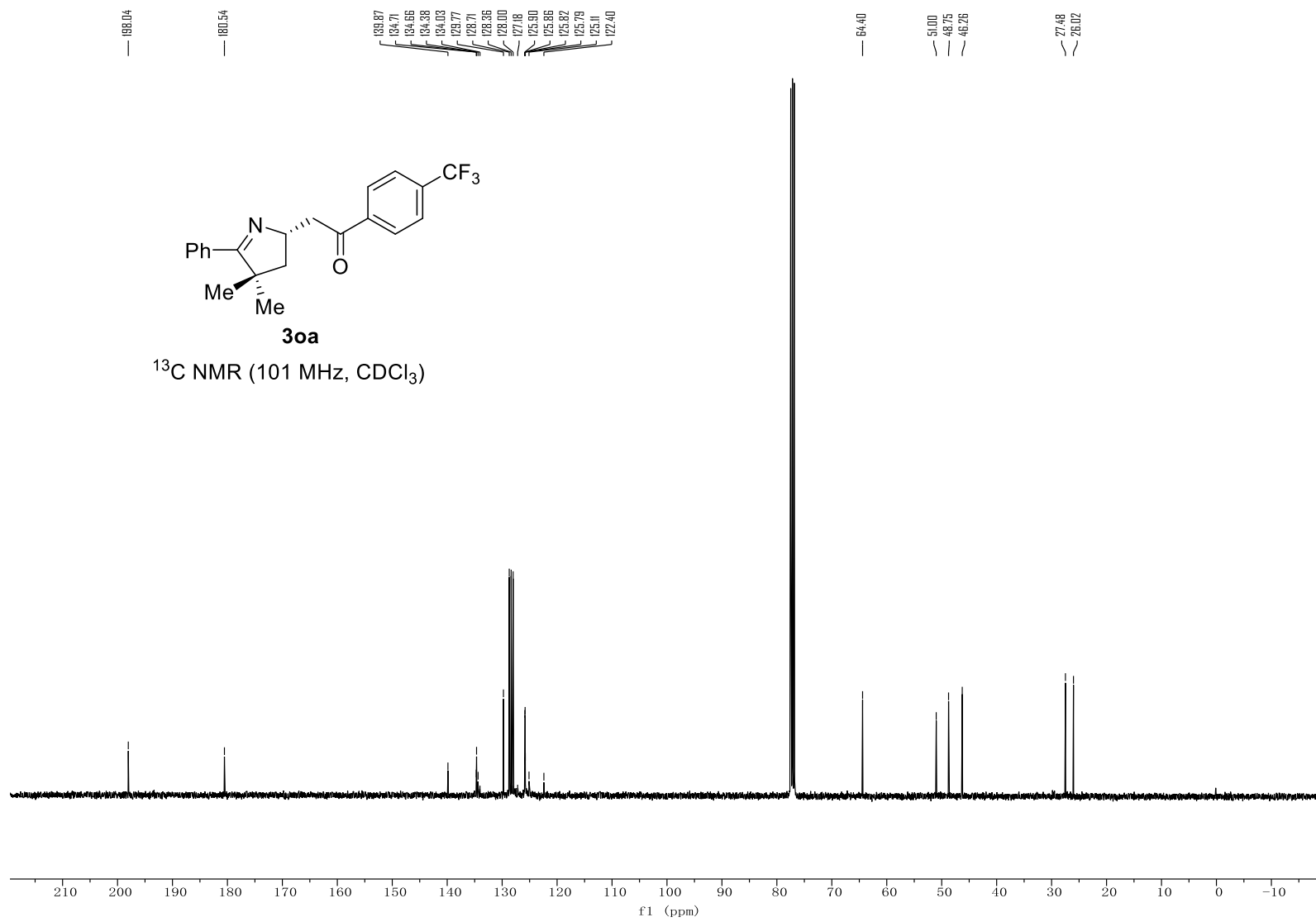


3na

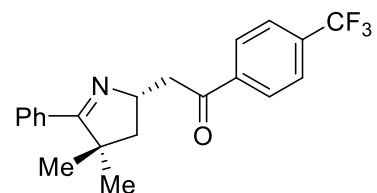
^{13}C NMR (101 MHz, CDCl_3)





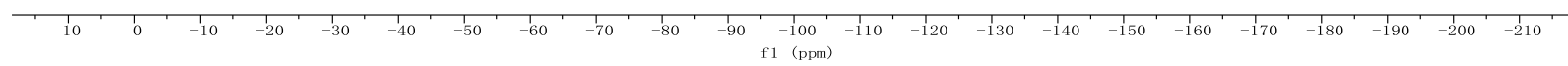


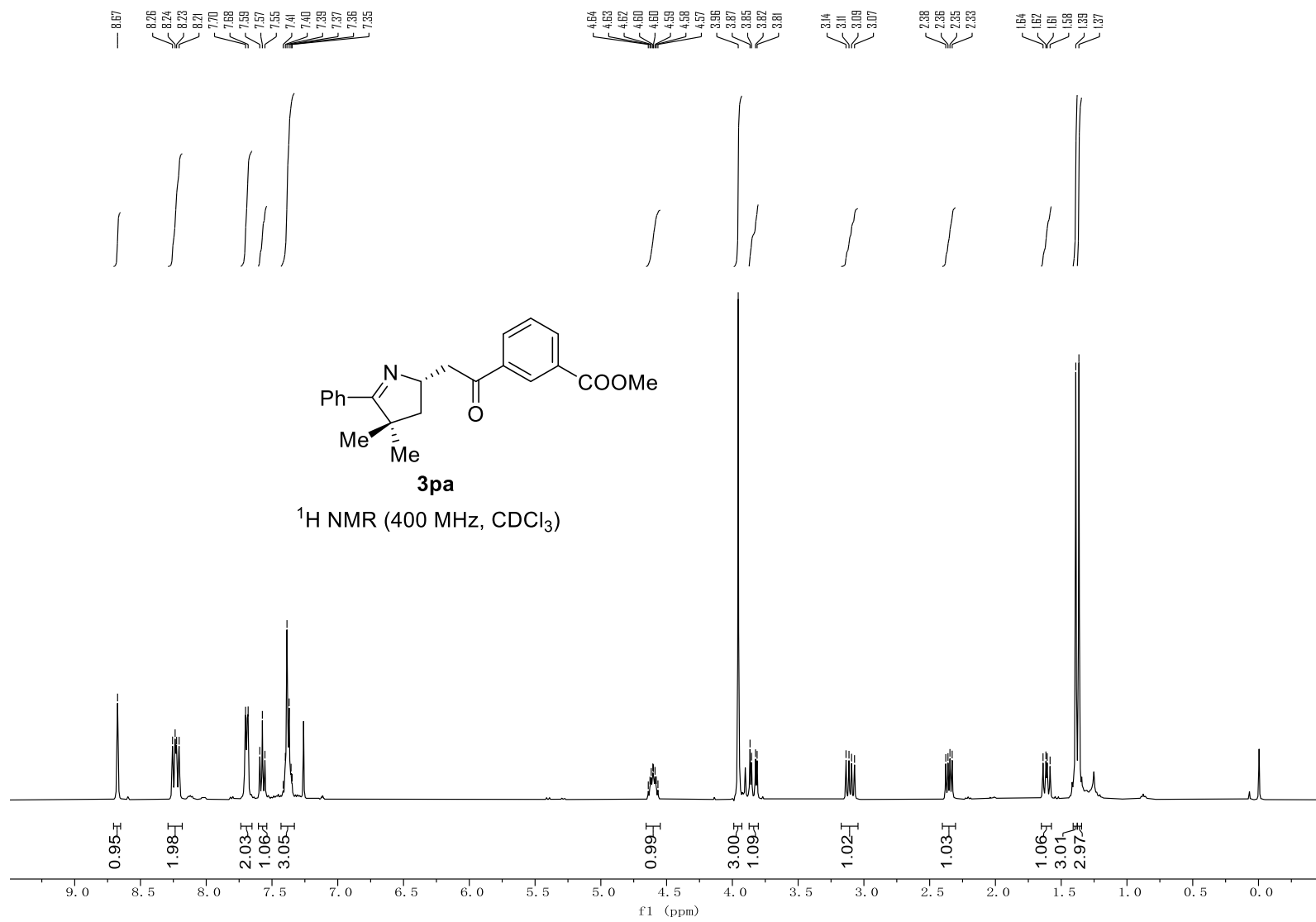
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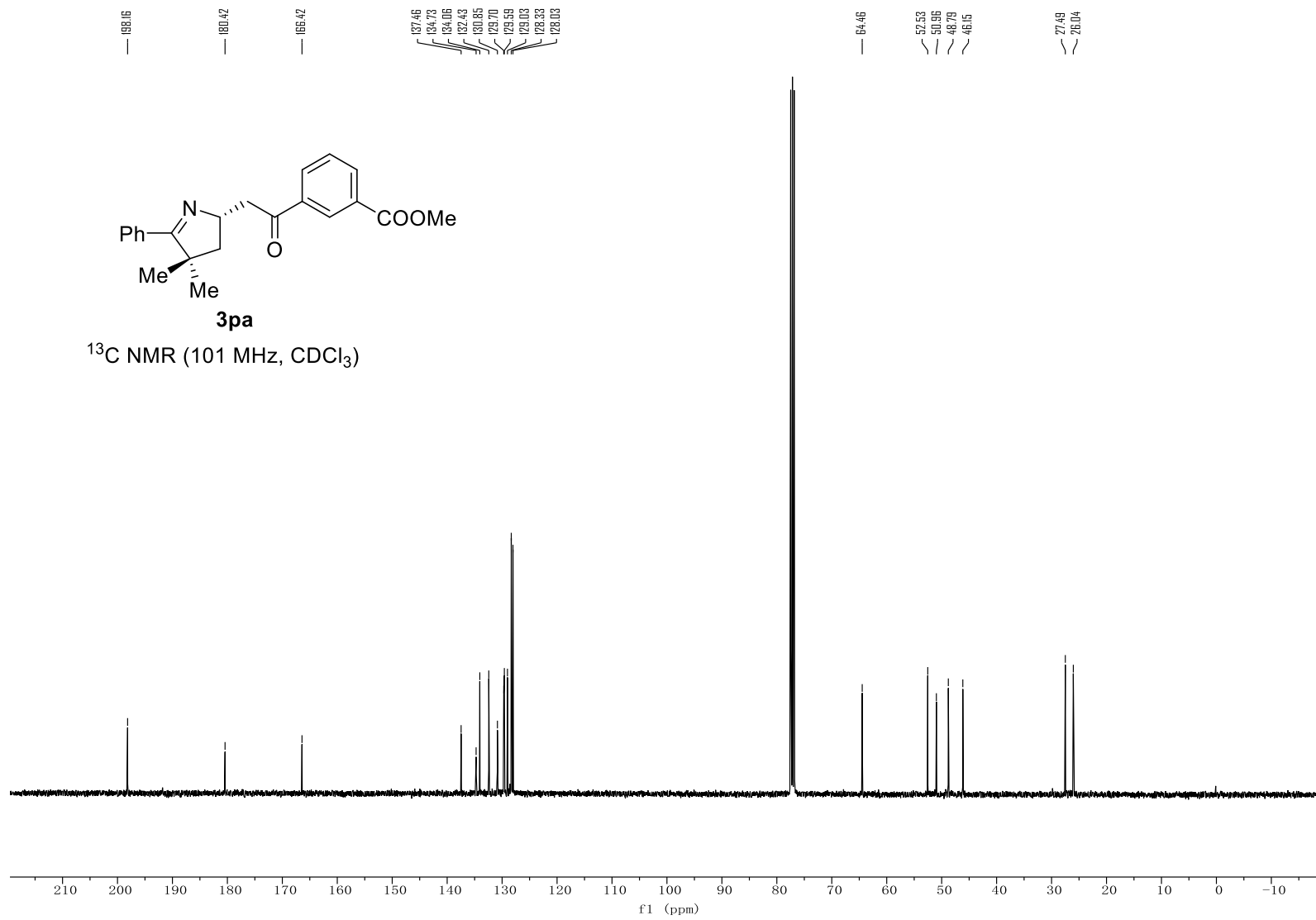


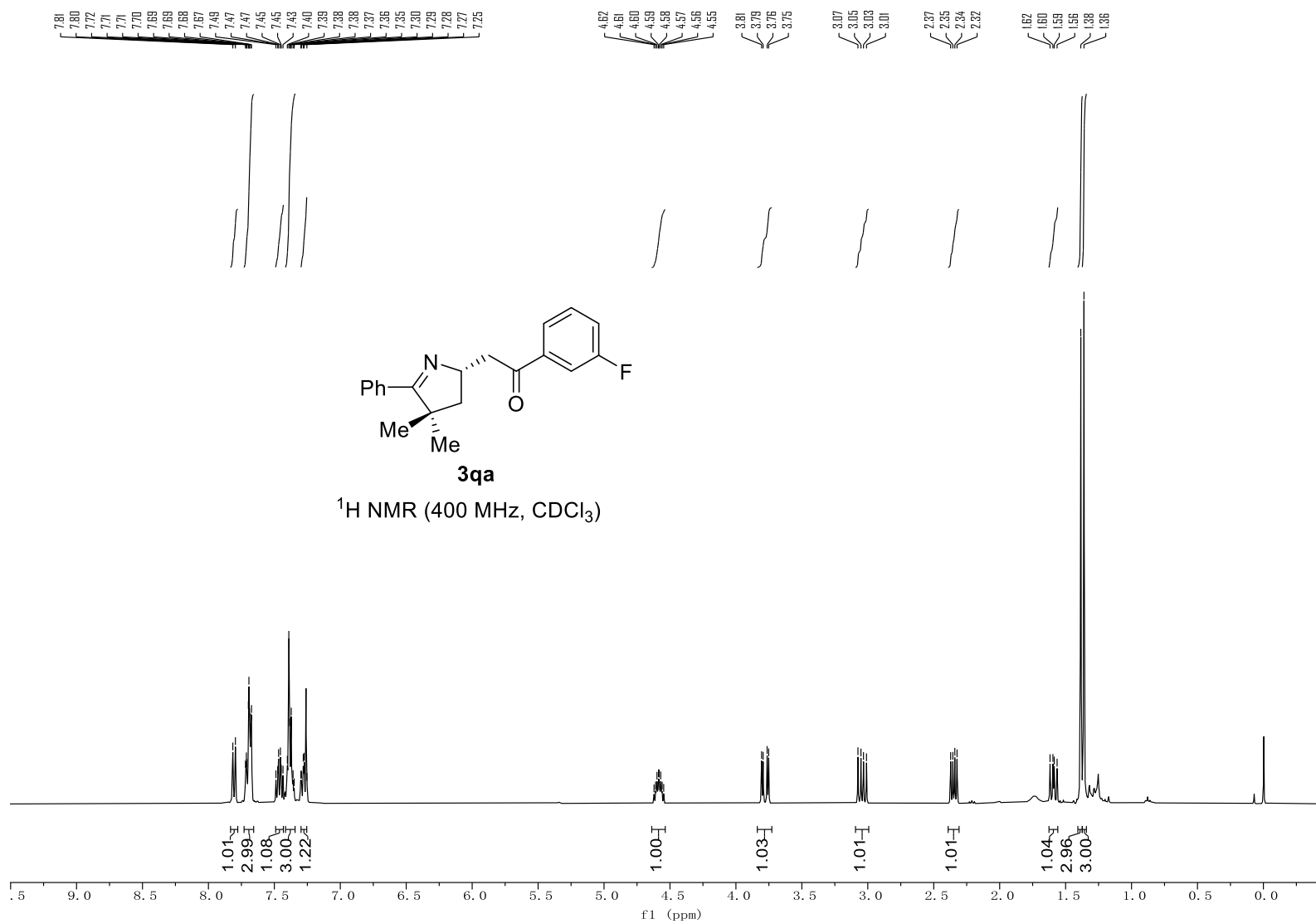
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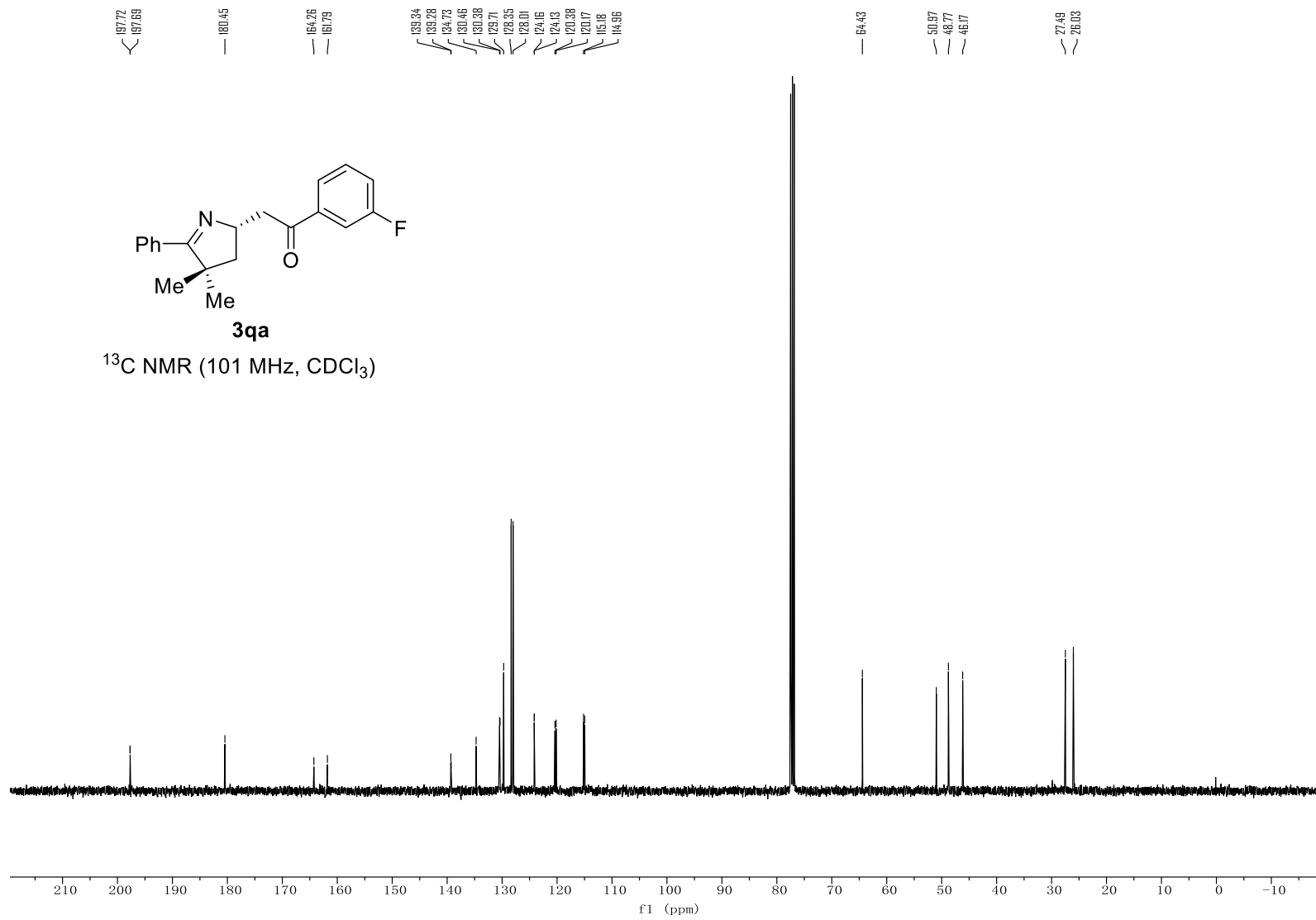
¹⁹F NMR (376 MHz, CDCl₃)

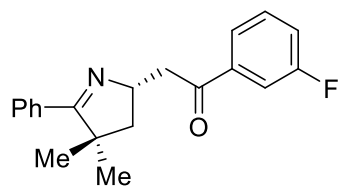






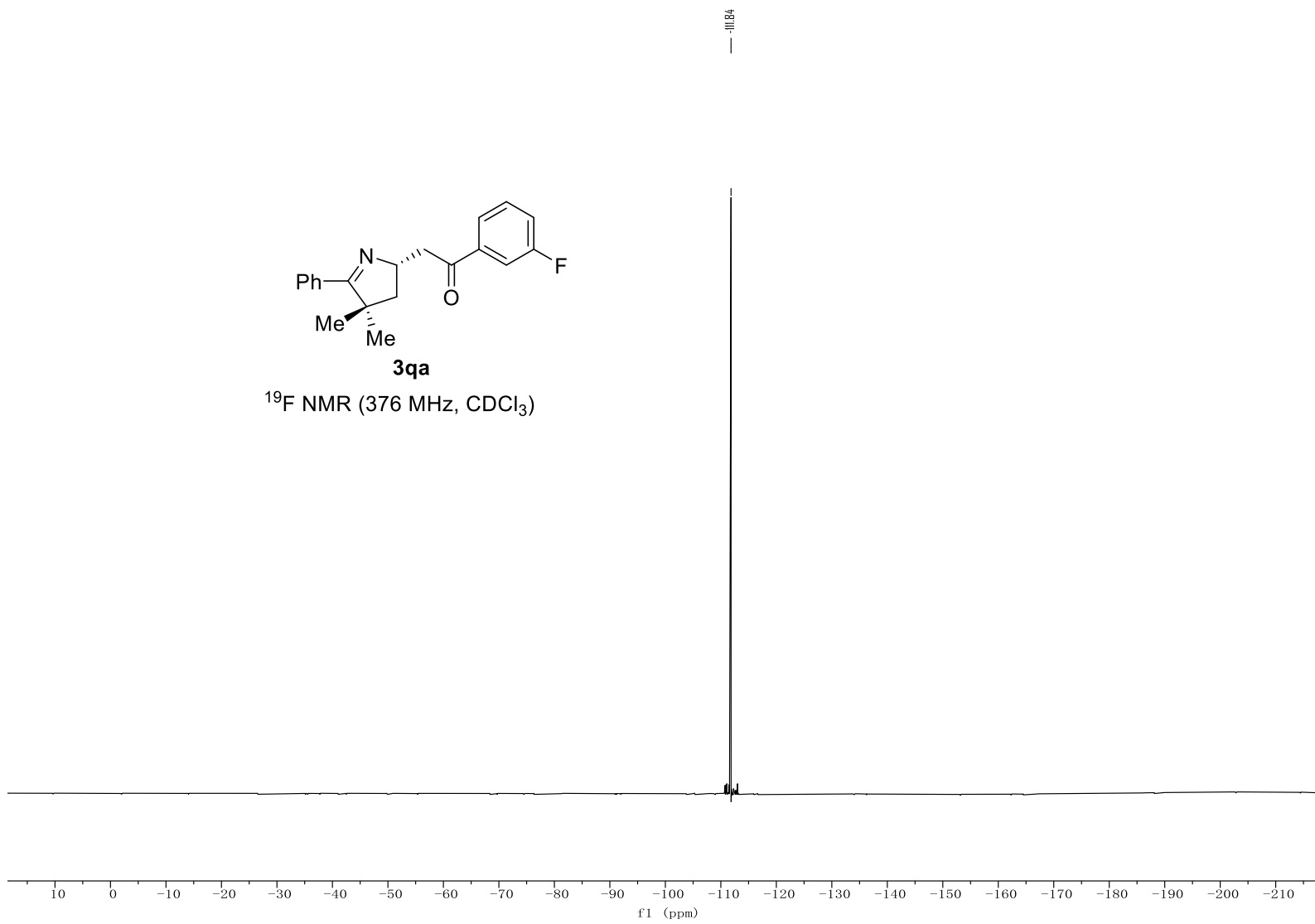


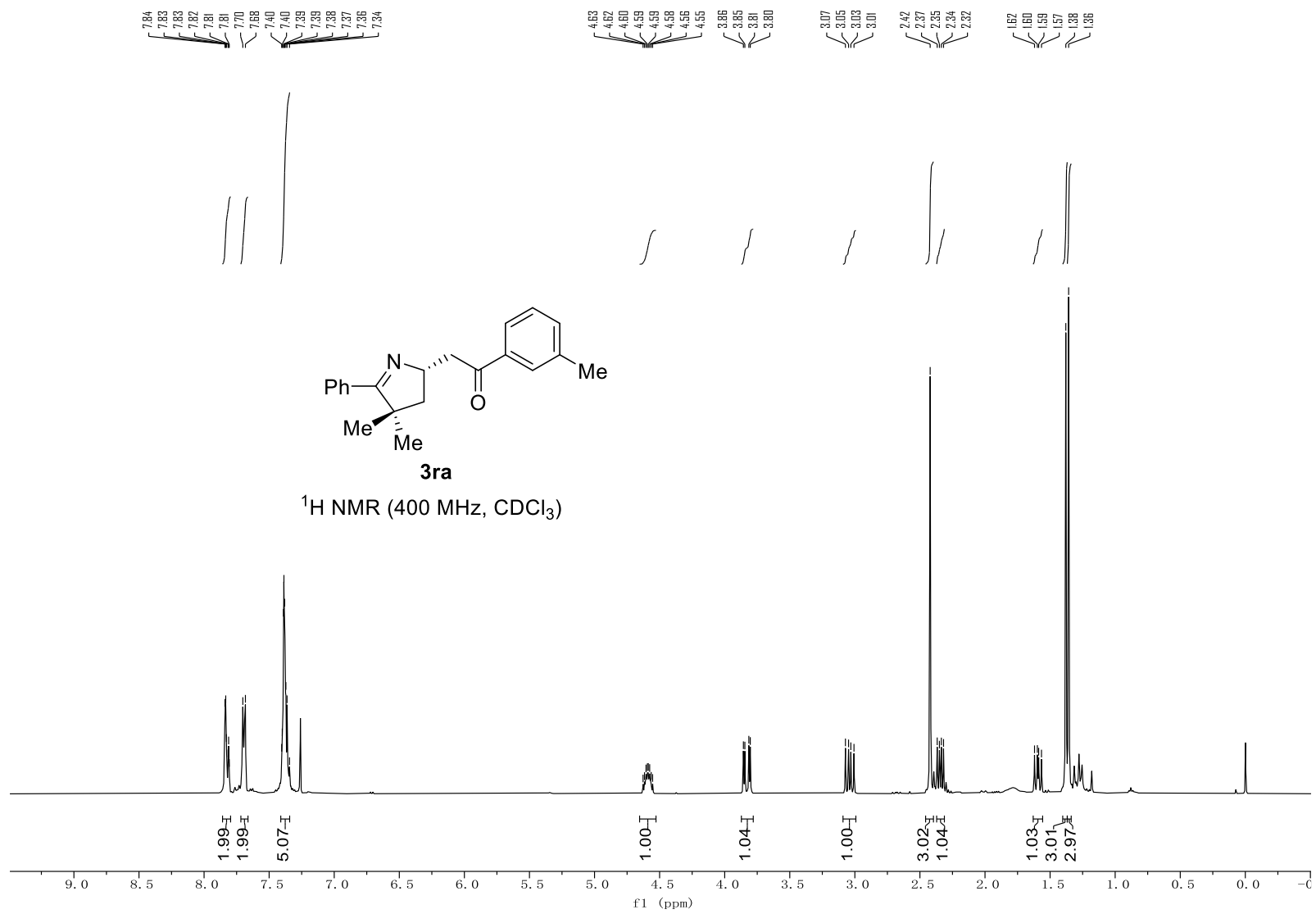


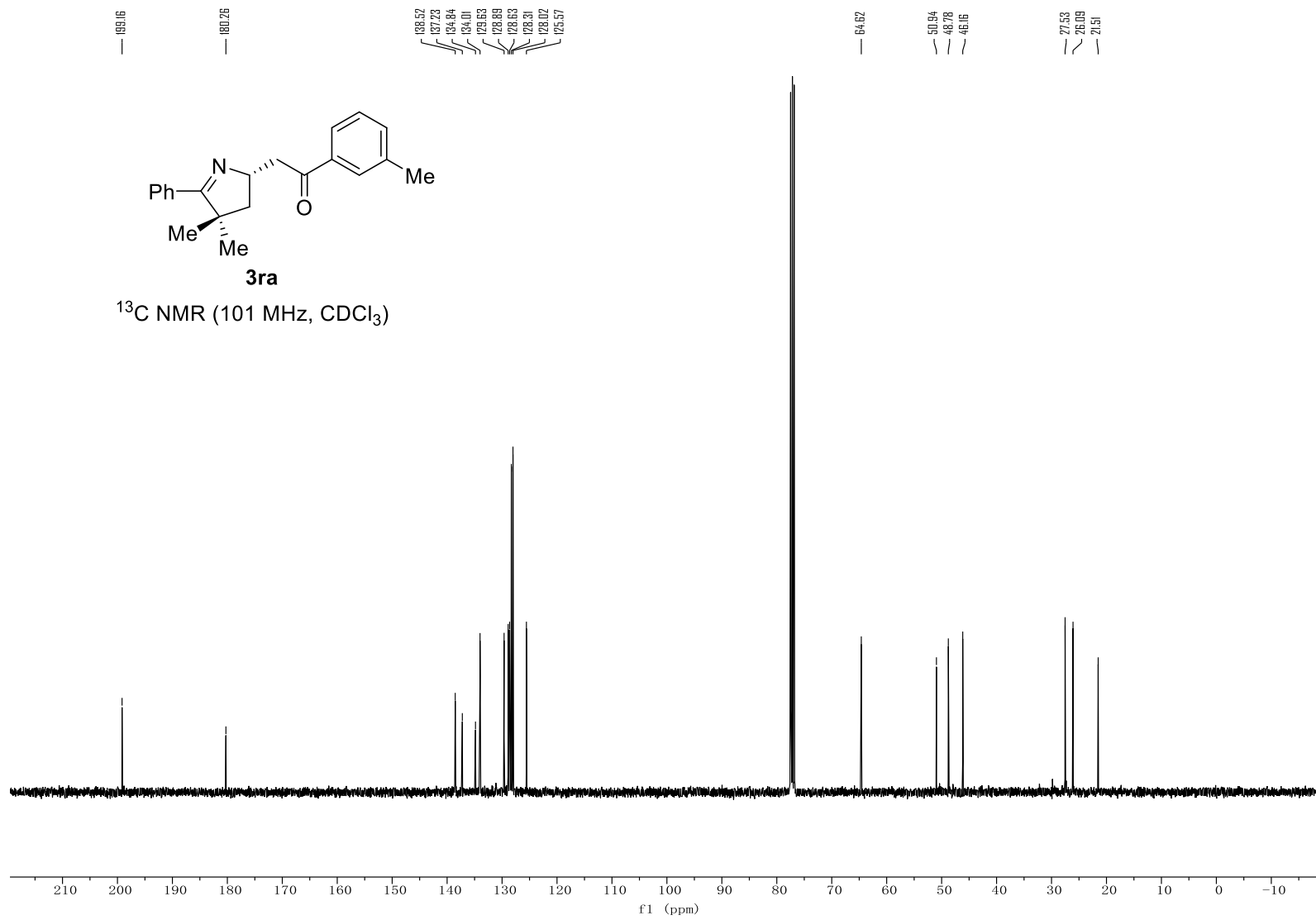


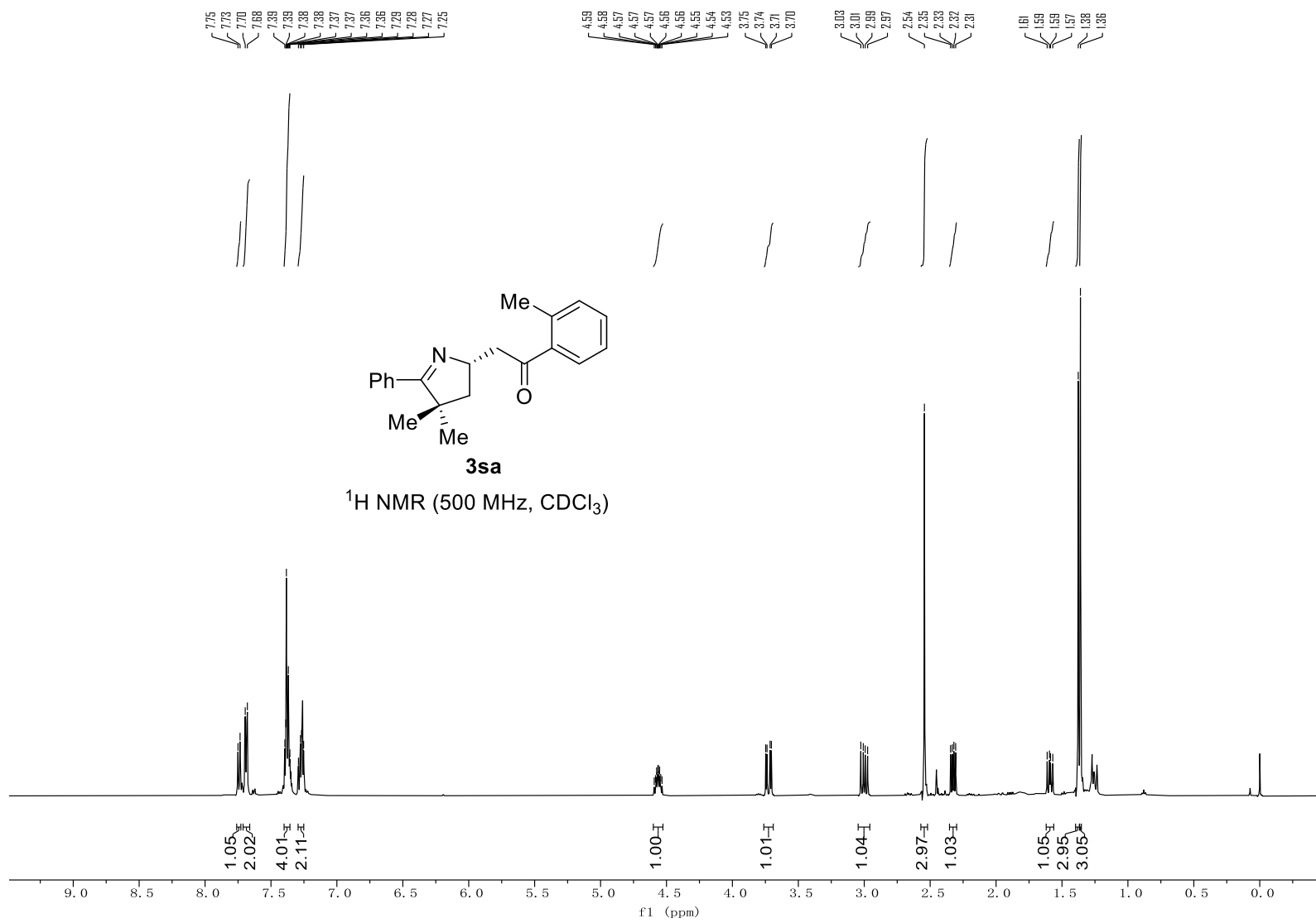
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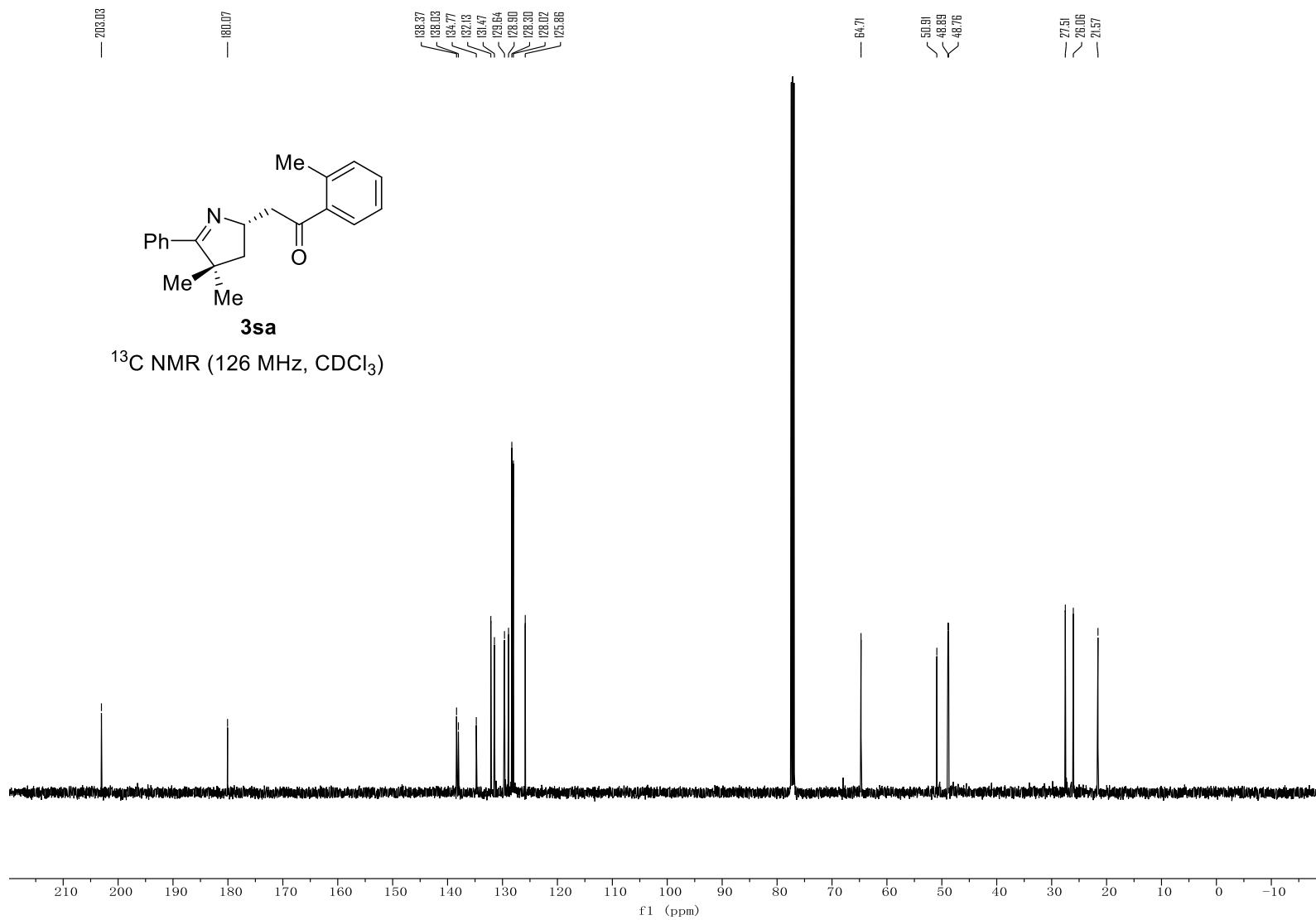
^{19}F NMR (376 MHz, CDCl_3)

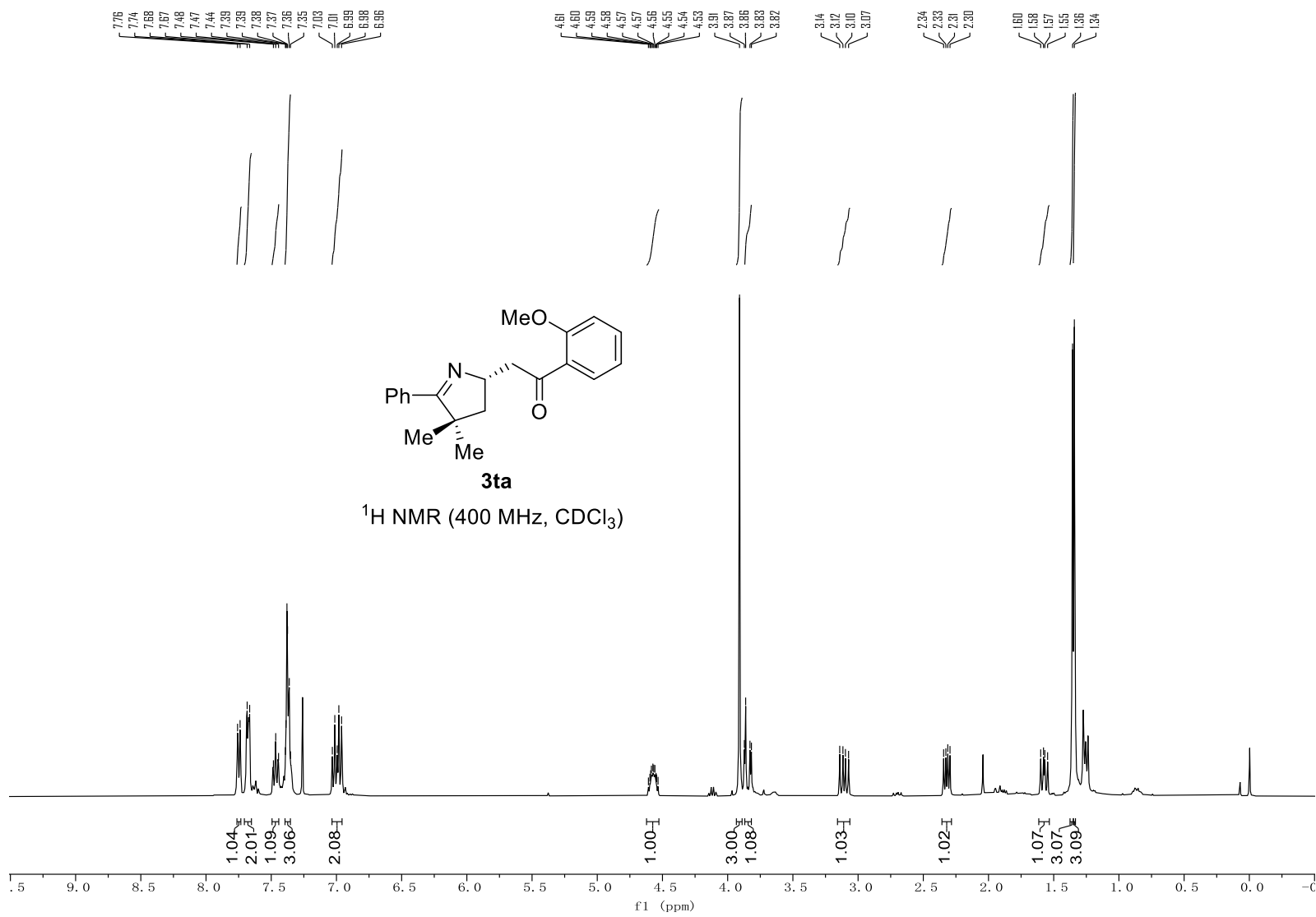


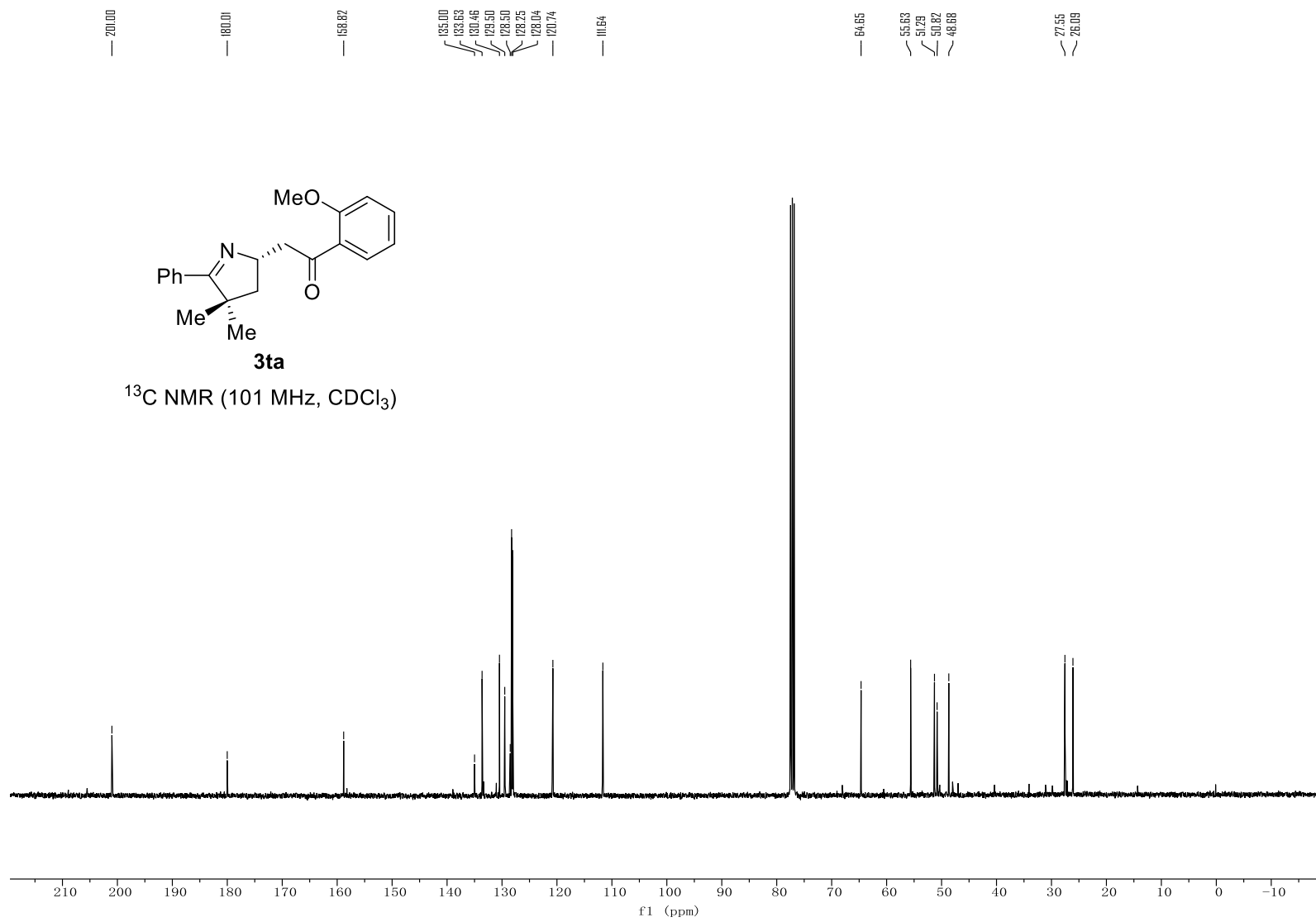


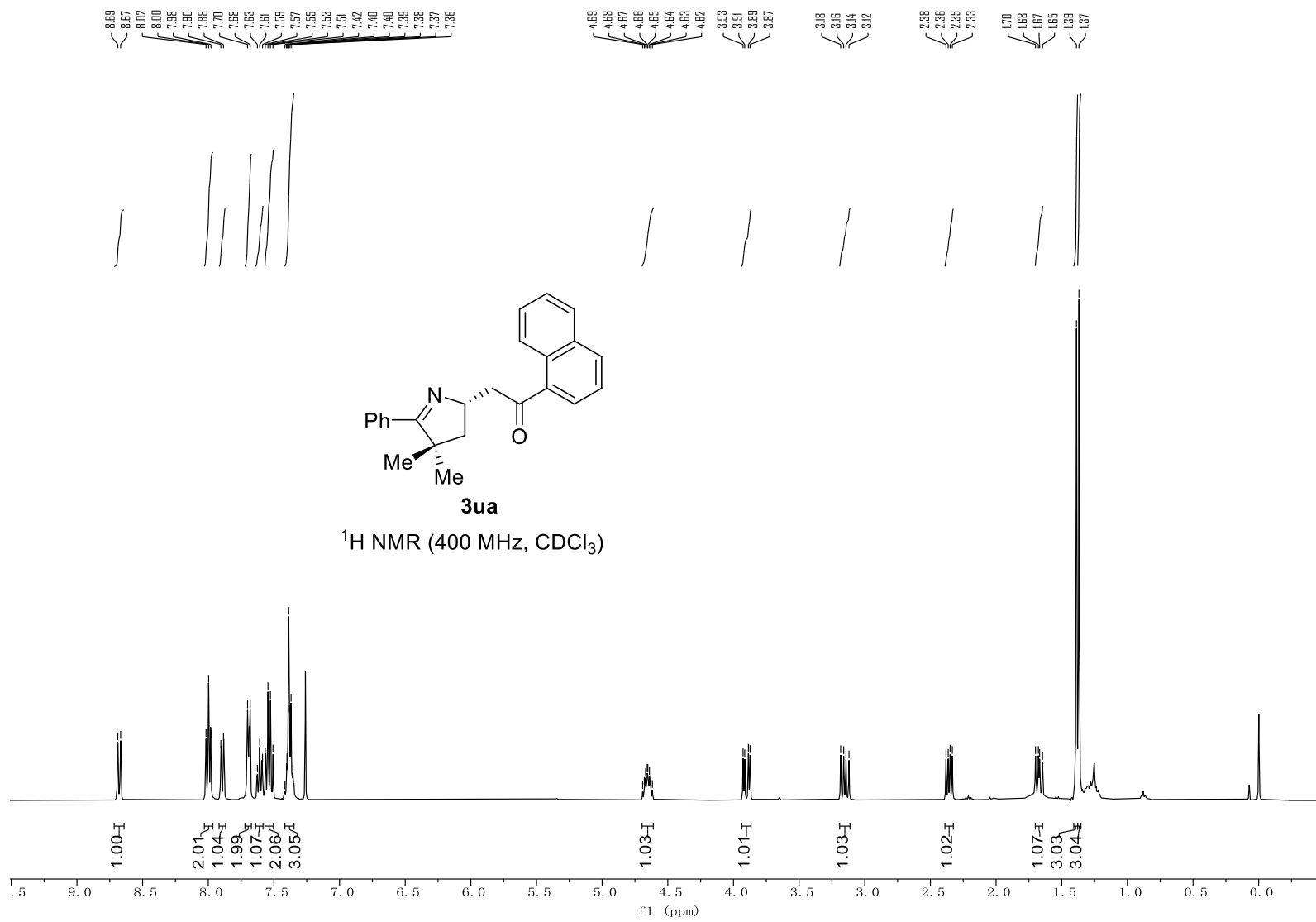


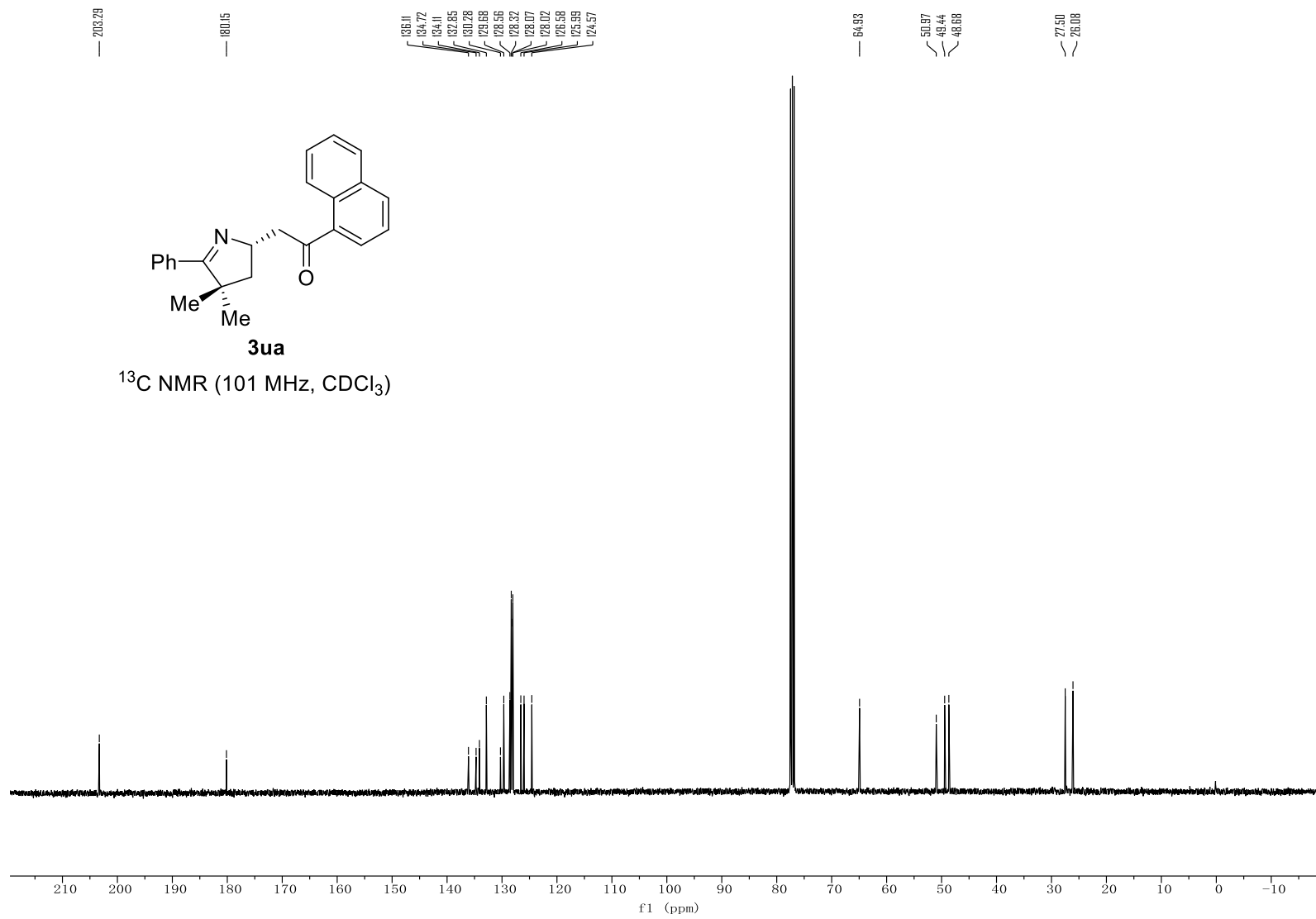


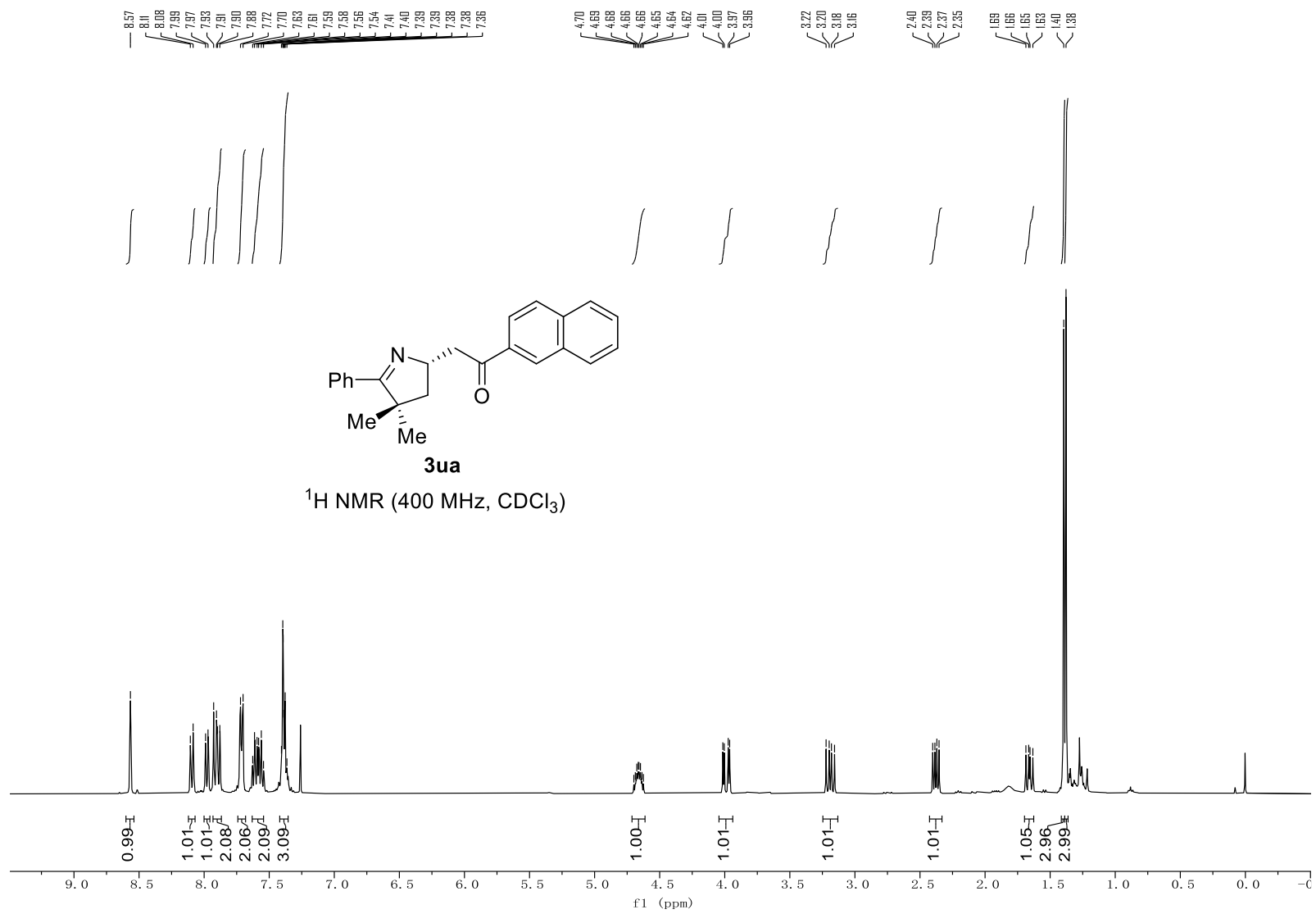


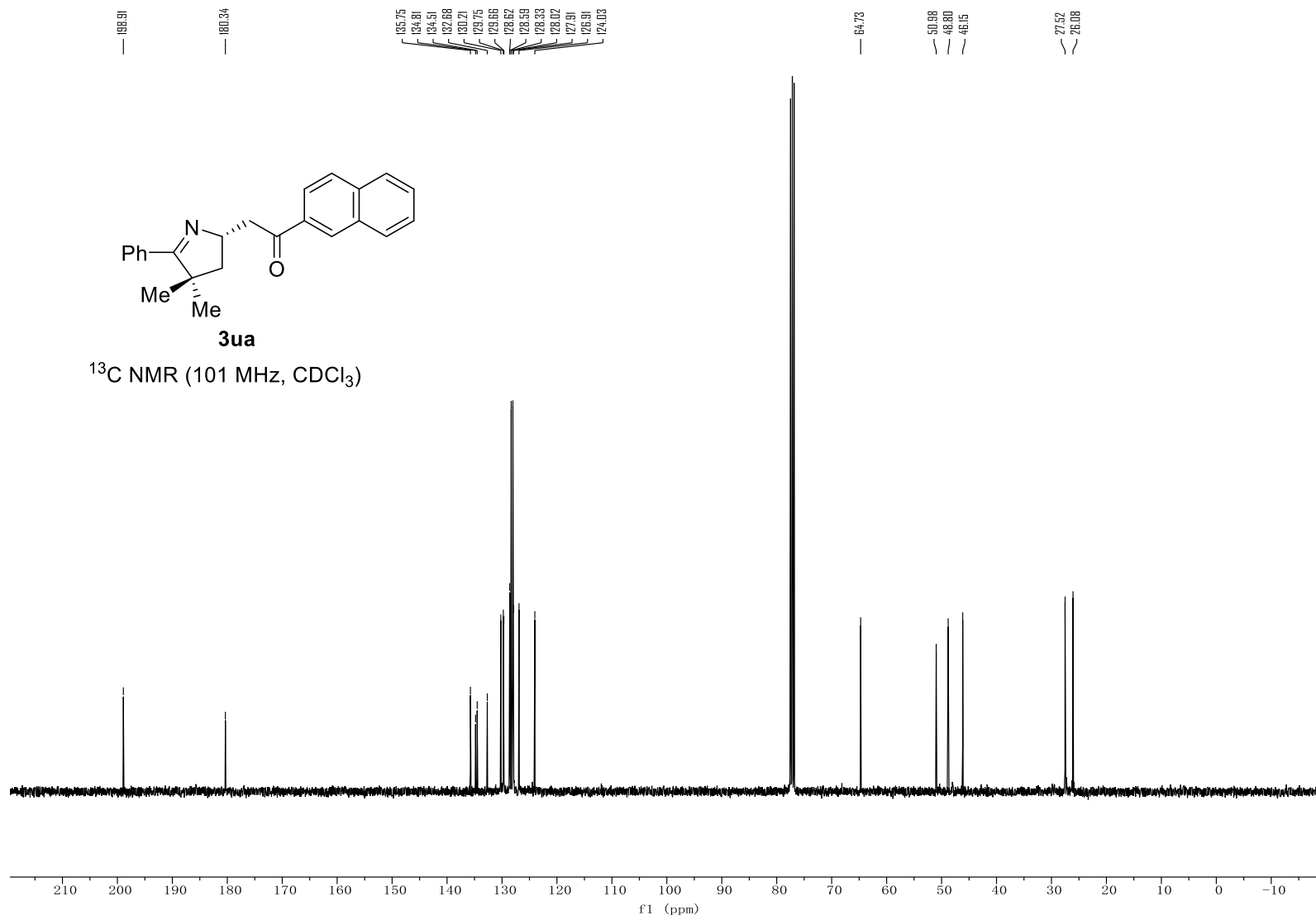


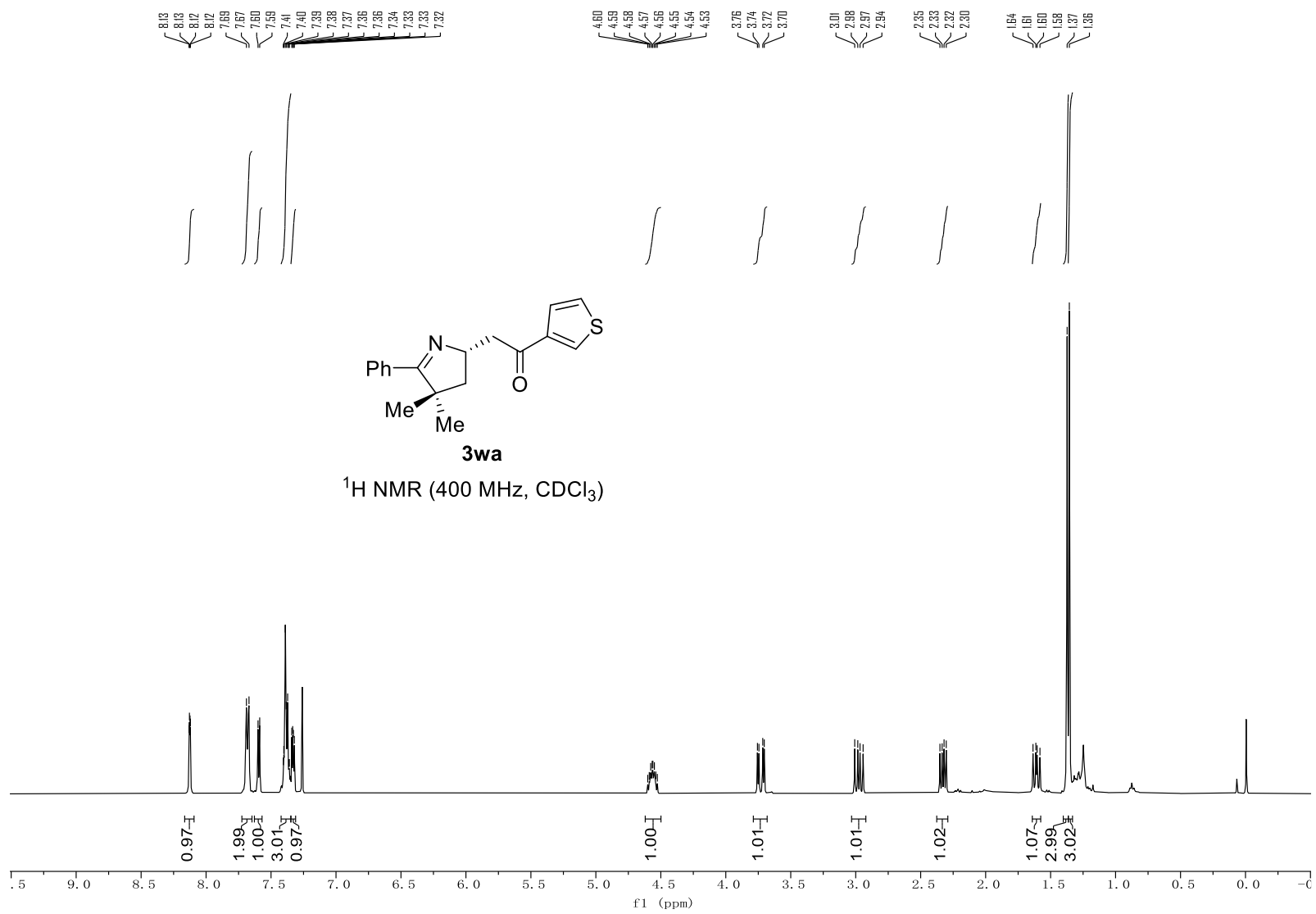


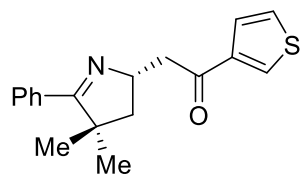






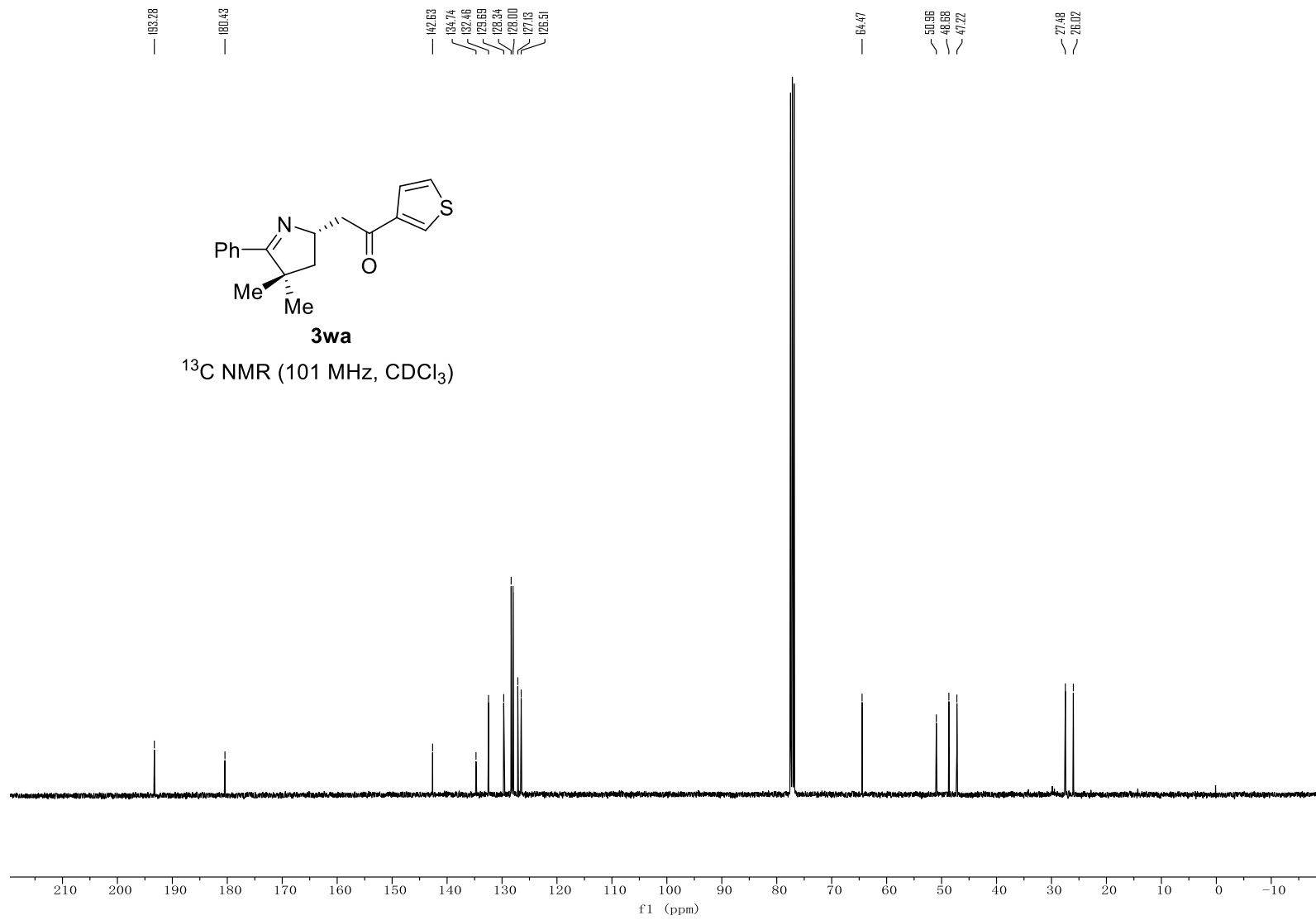


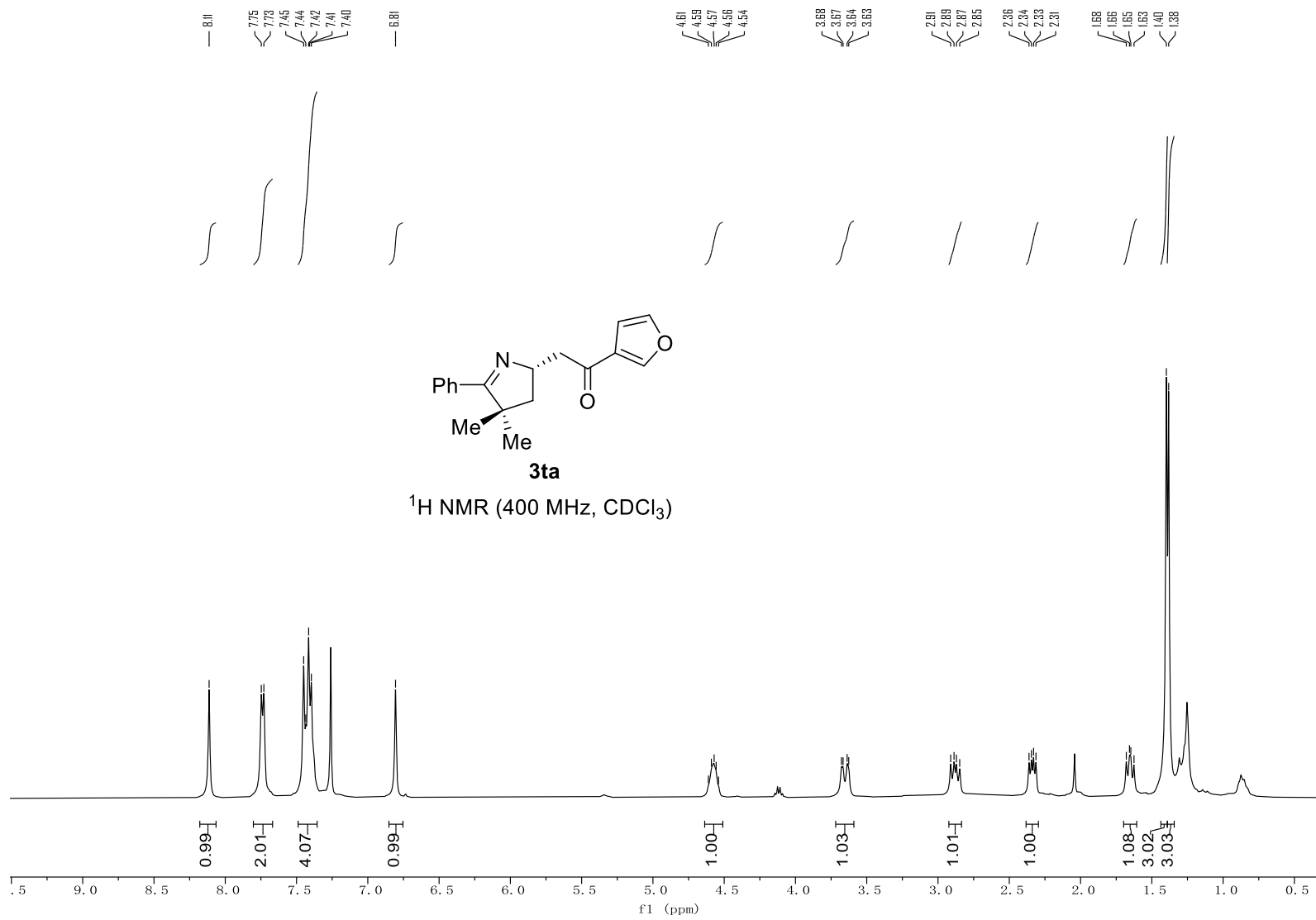


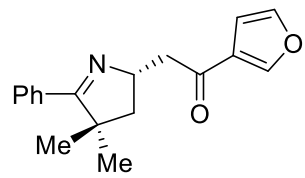


3wa

^{13}C NMR (101 MHz, CDCl_3)

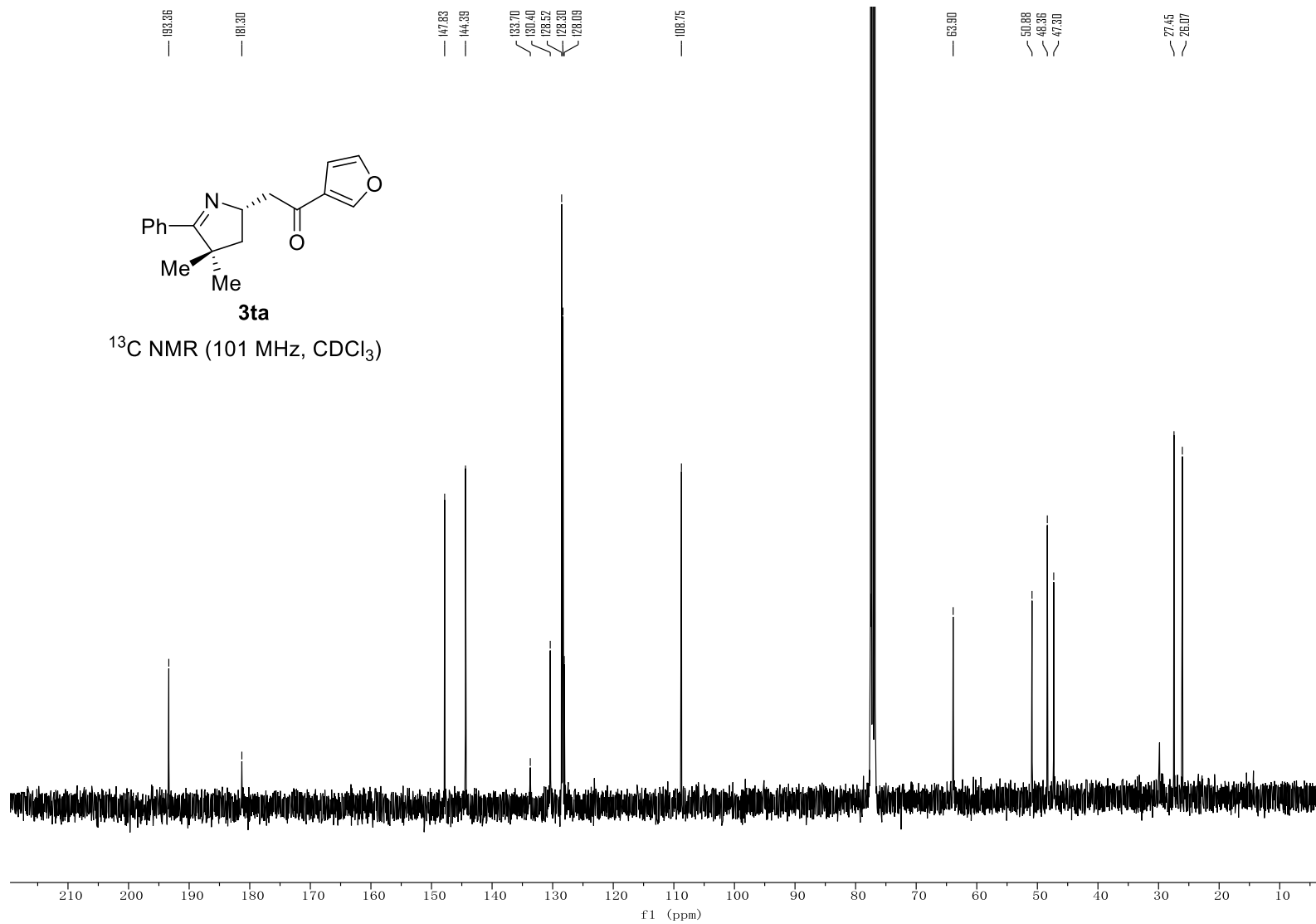


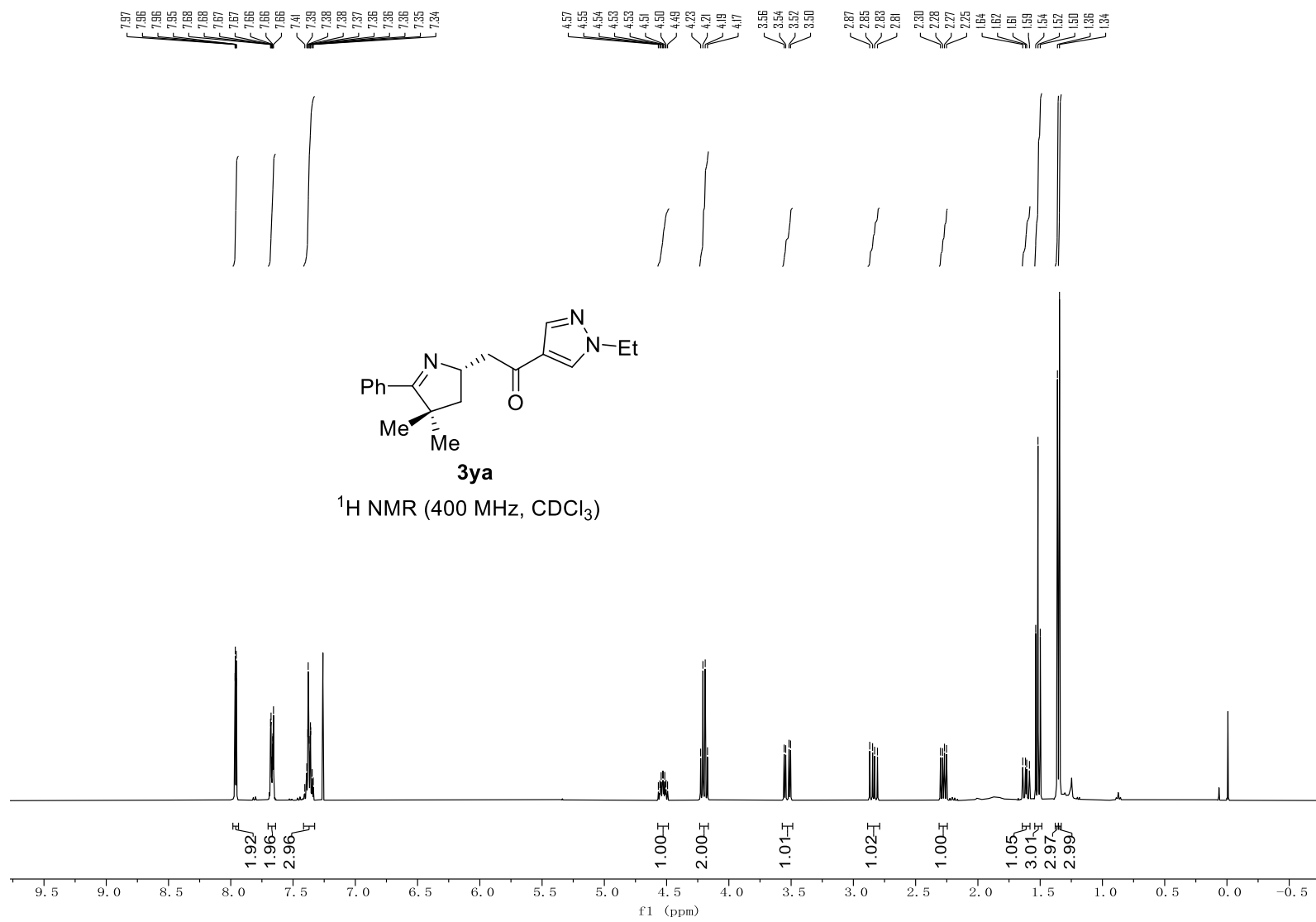


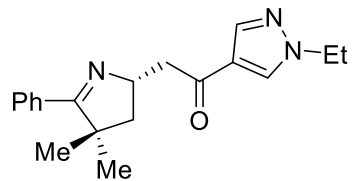


3ta

^{13}C NMR (101 MHz, CDCl_3)

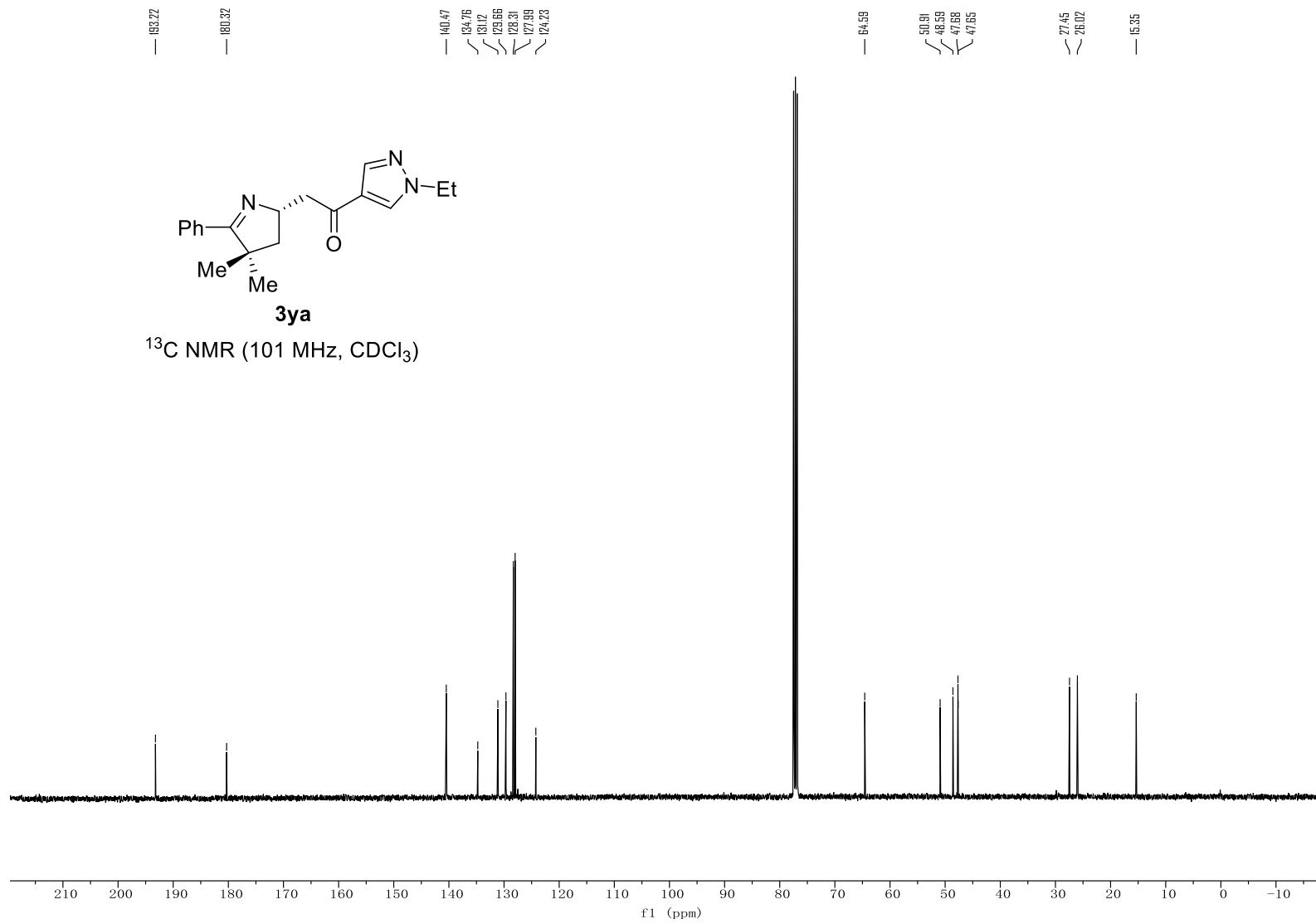


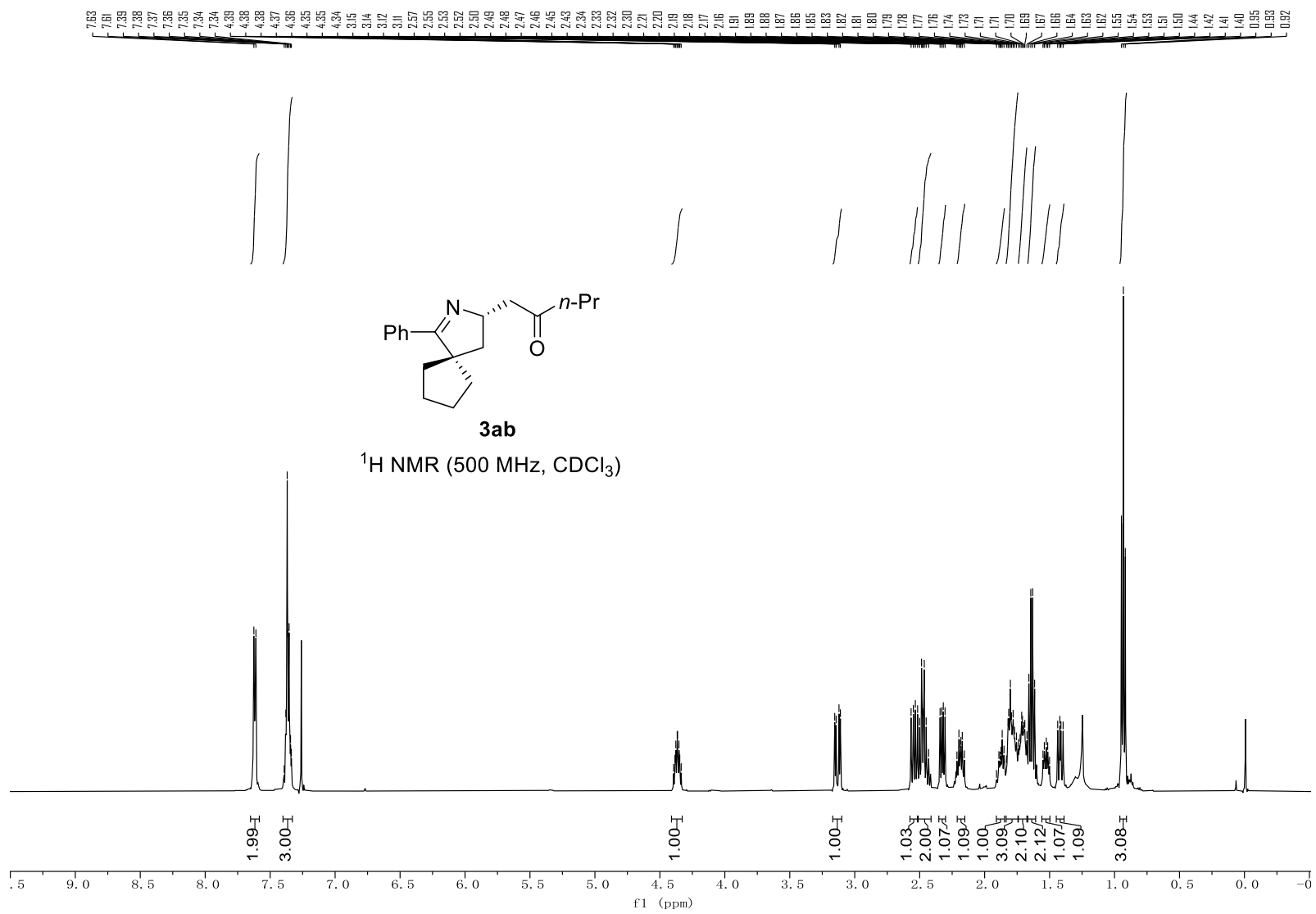


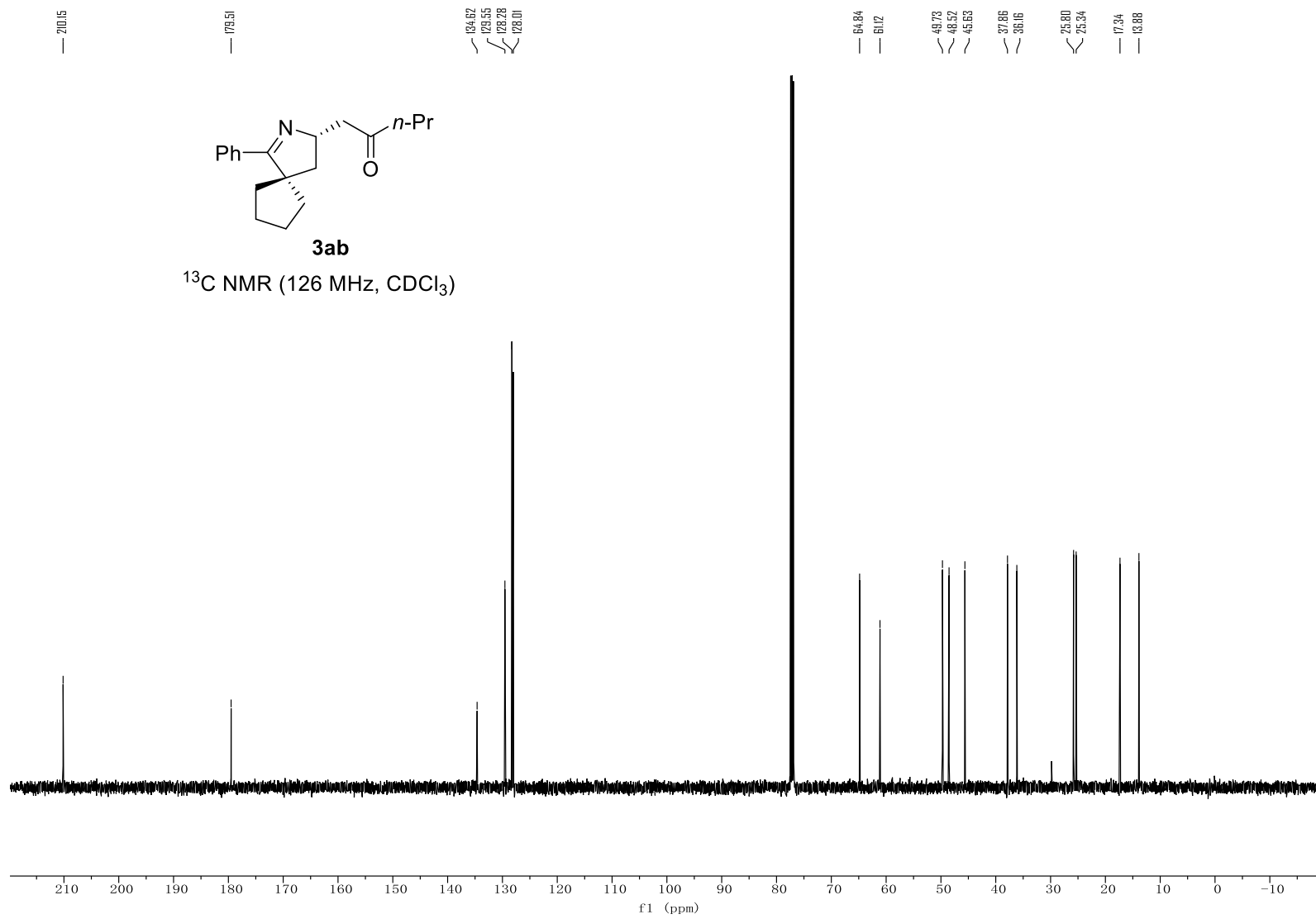


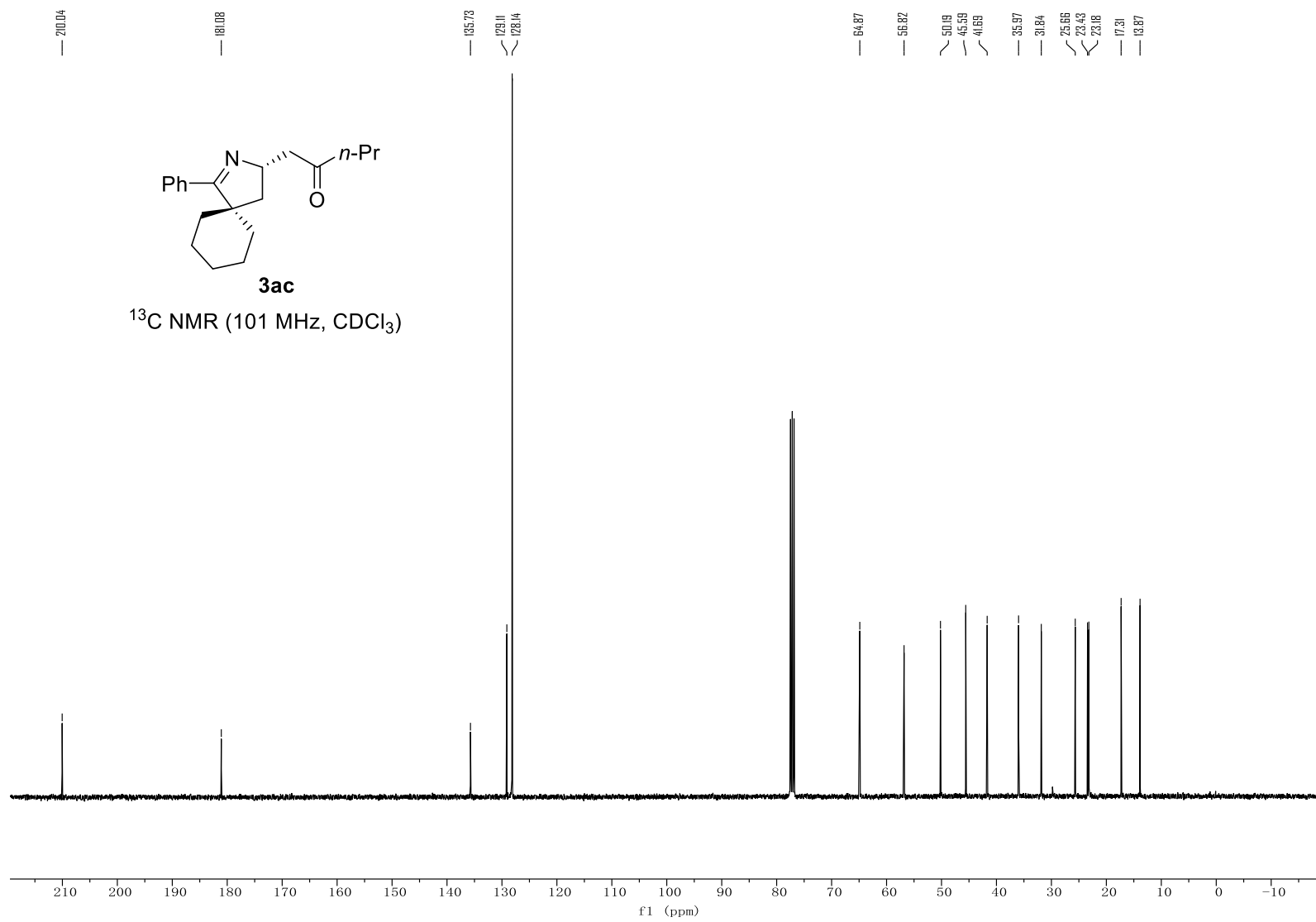
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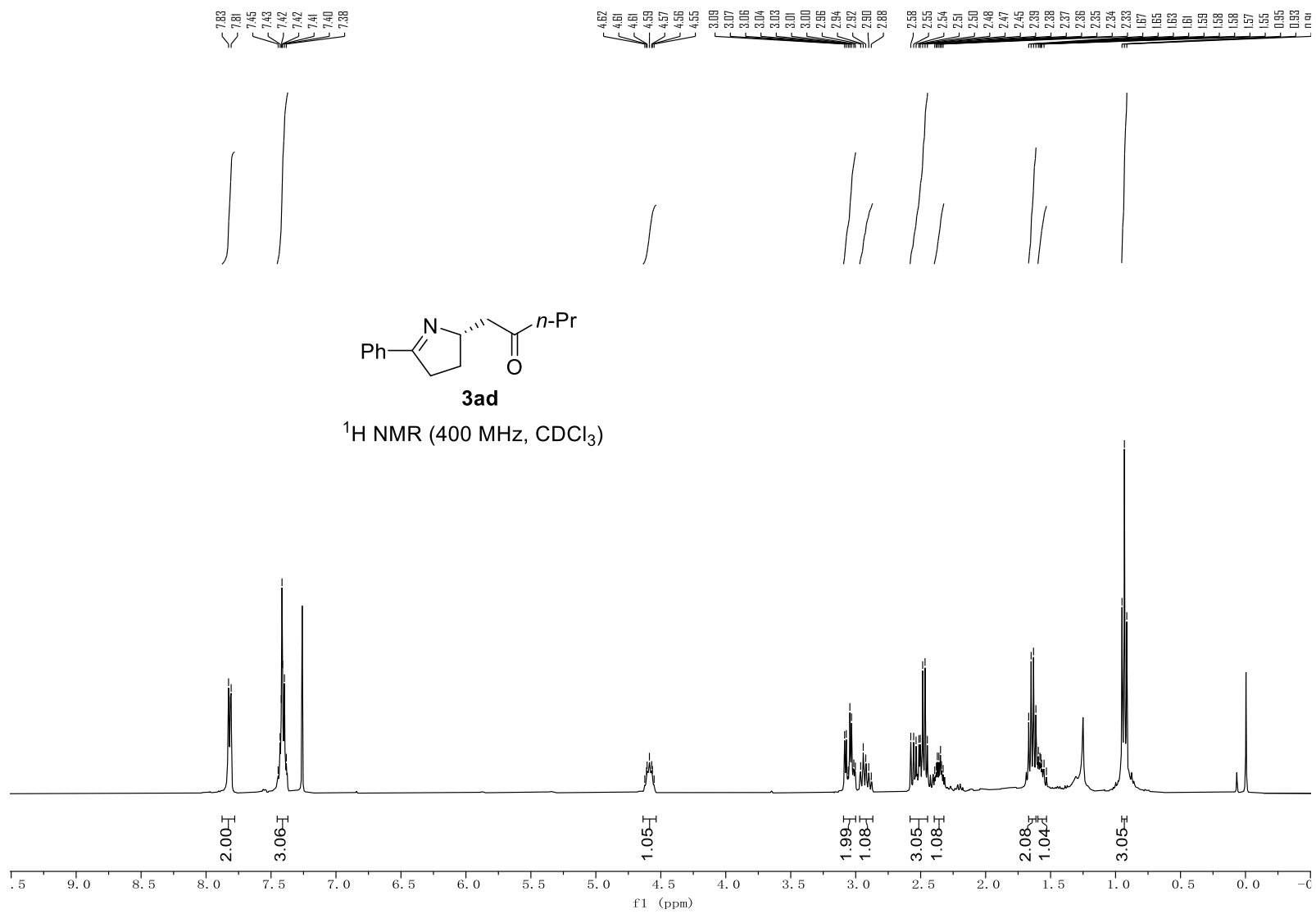
^{13}C NMR (101 MHz, CDCl_3)

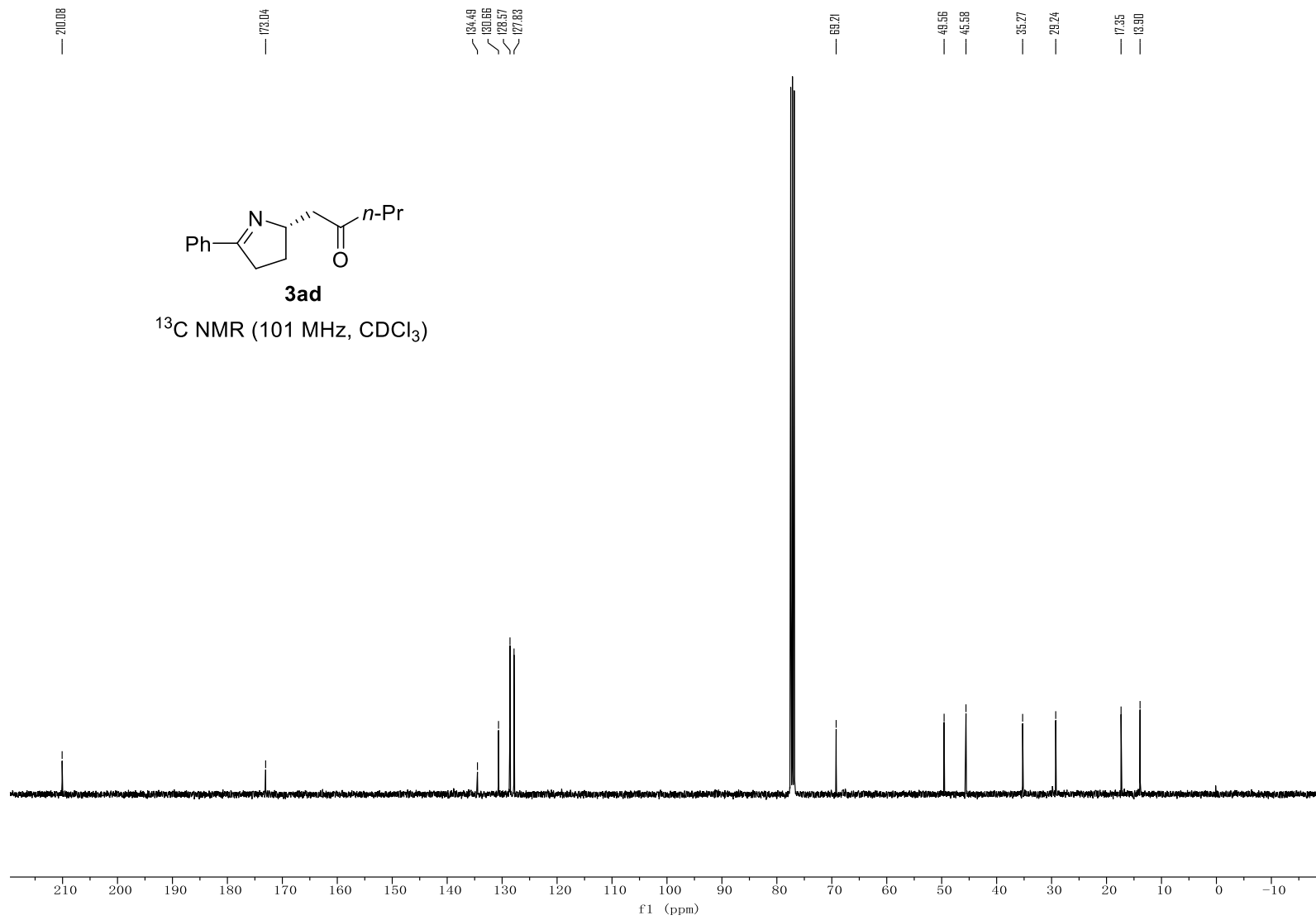






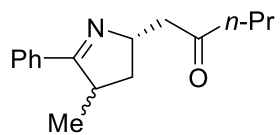
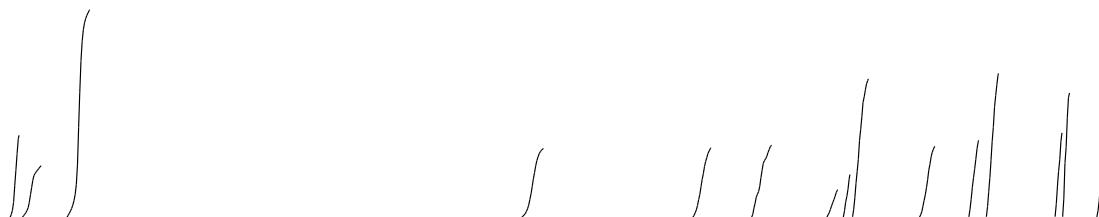






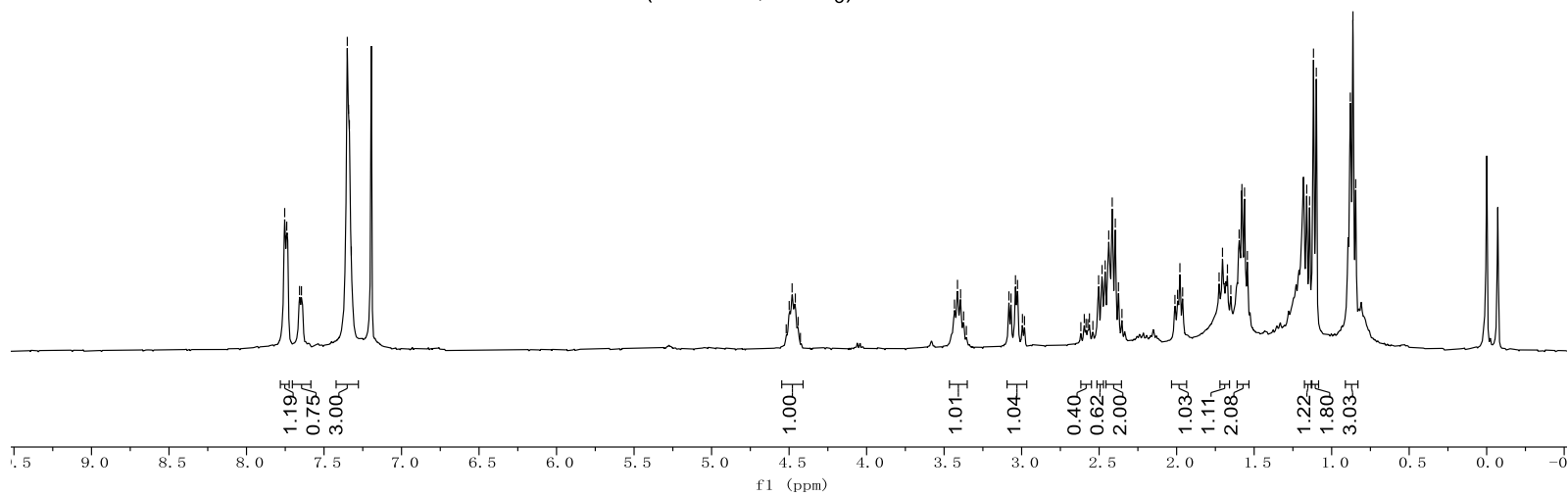
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7.74
7.66
7.65
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7.34
7.34
7.32

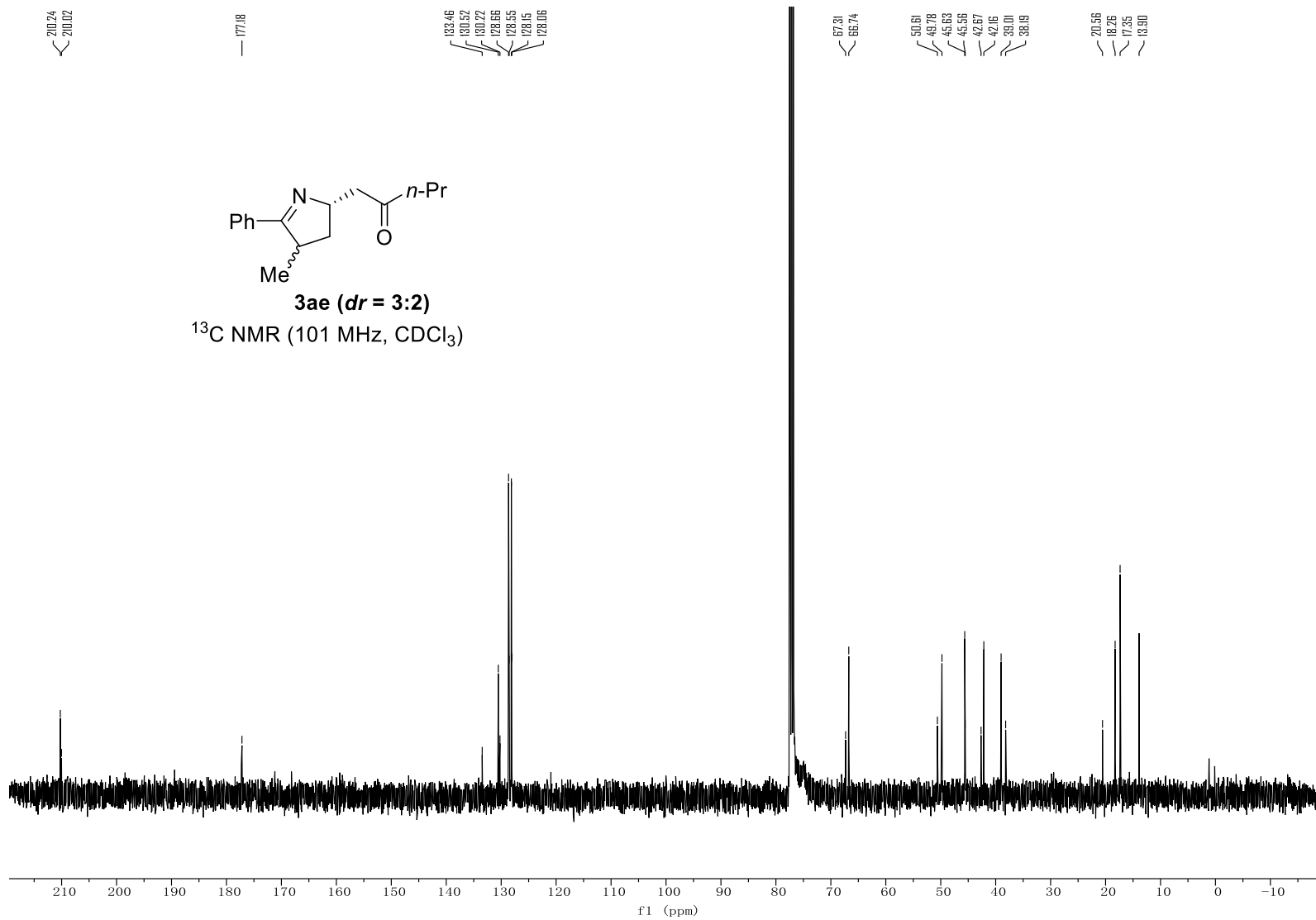
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4.48
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4.44
4.43
3.43
3.41
3.39
3.37
3.36
3.08
3.07
3.04
3.03
2.99
2.98
2.56
2.50
2.48
2.46
2.44
2.42
2.40
2.38
2.35
2.01
1.99
1.98
1.95
1.73
1.70
1.67
1.65
1.60
1.58
1.56
1.54
1.14
1.12
1.10
0.88
0.86
0.84

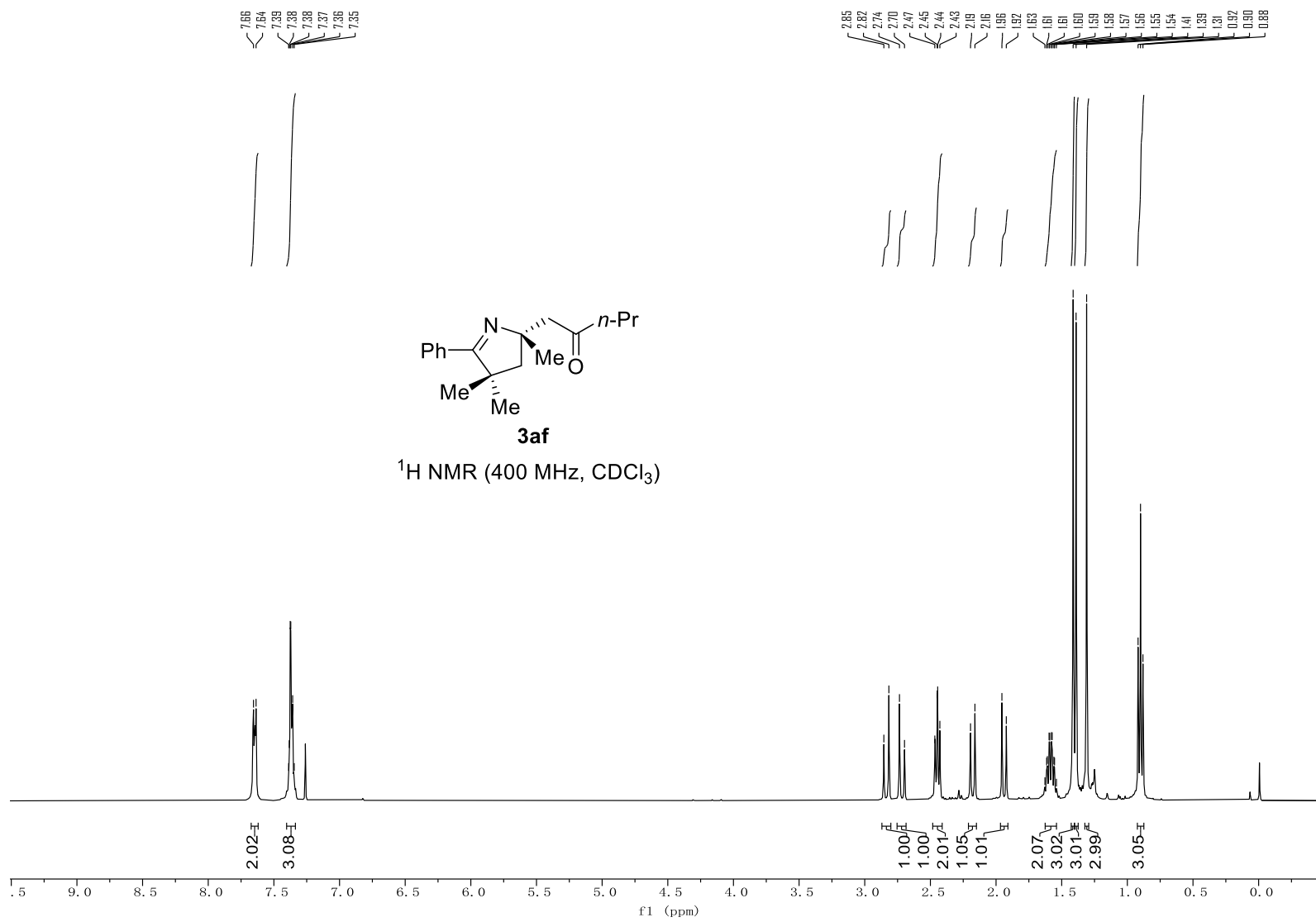


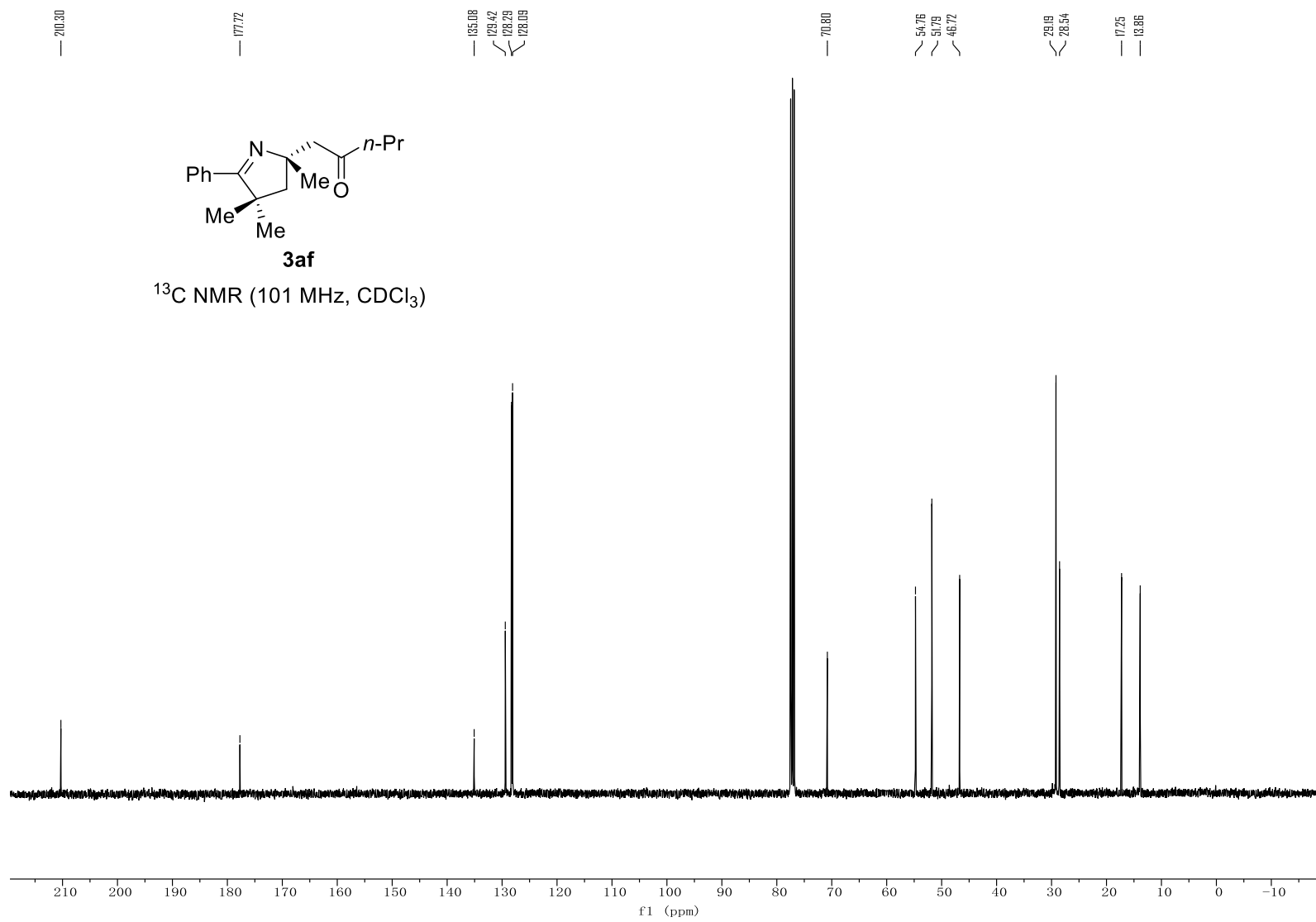
3ae (dr = 3:2)

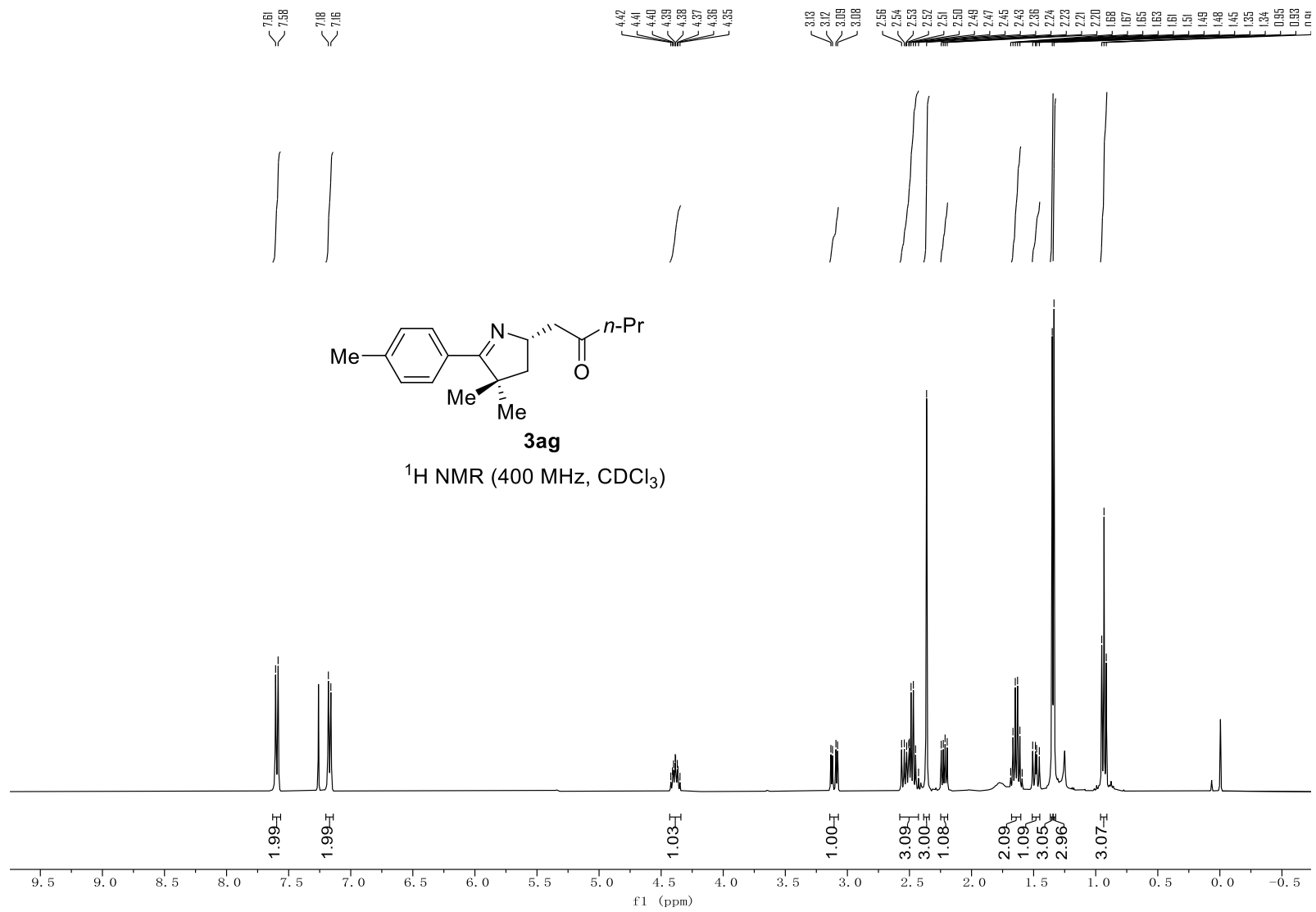
¹H NMR (400 MHz, CDCl₃)

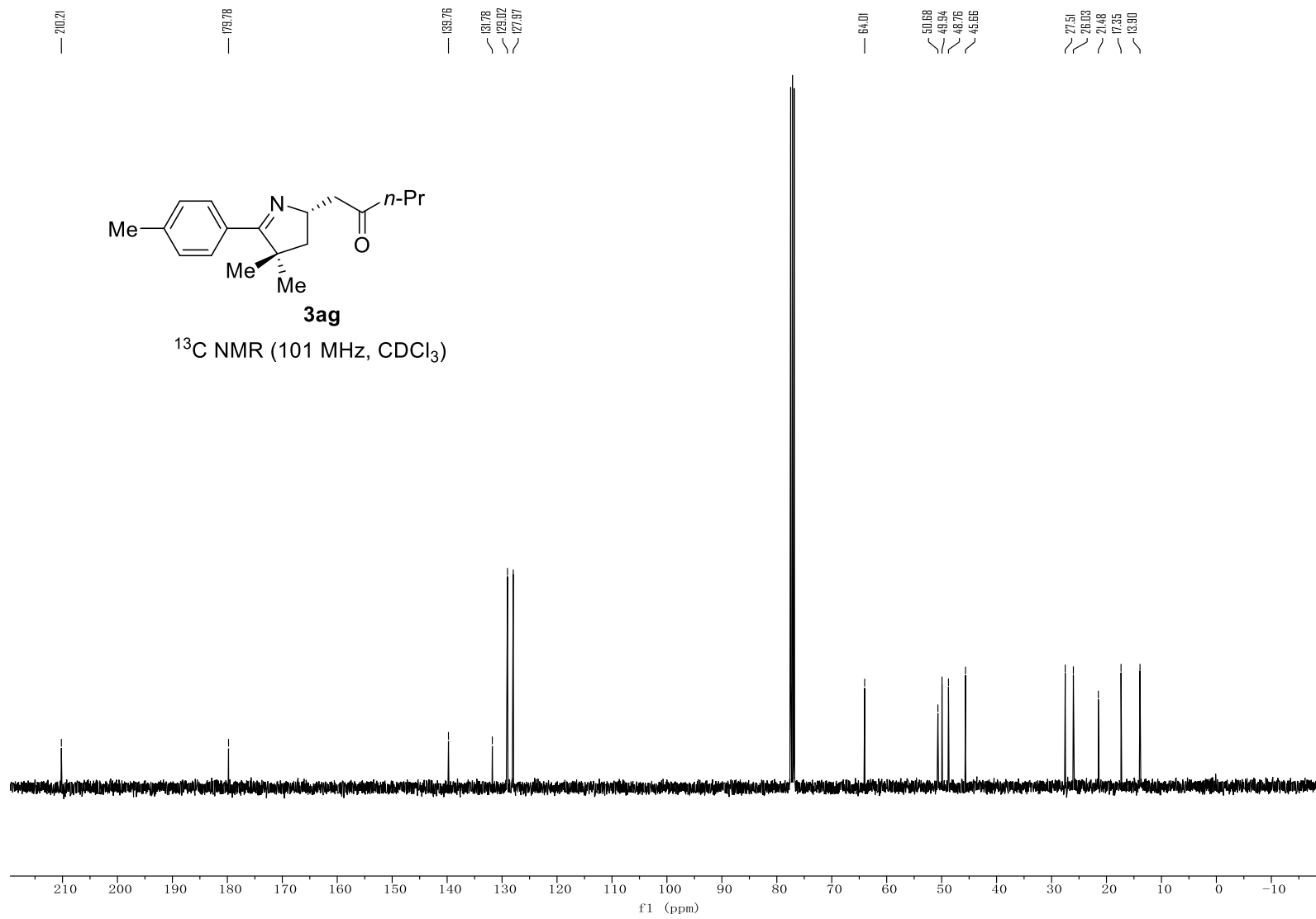


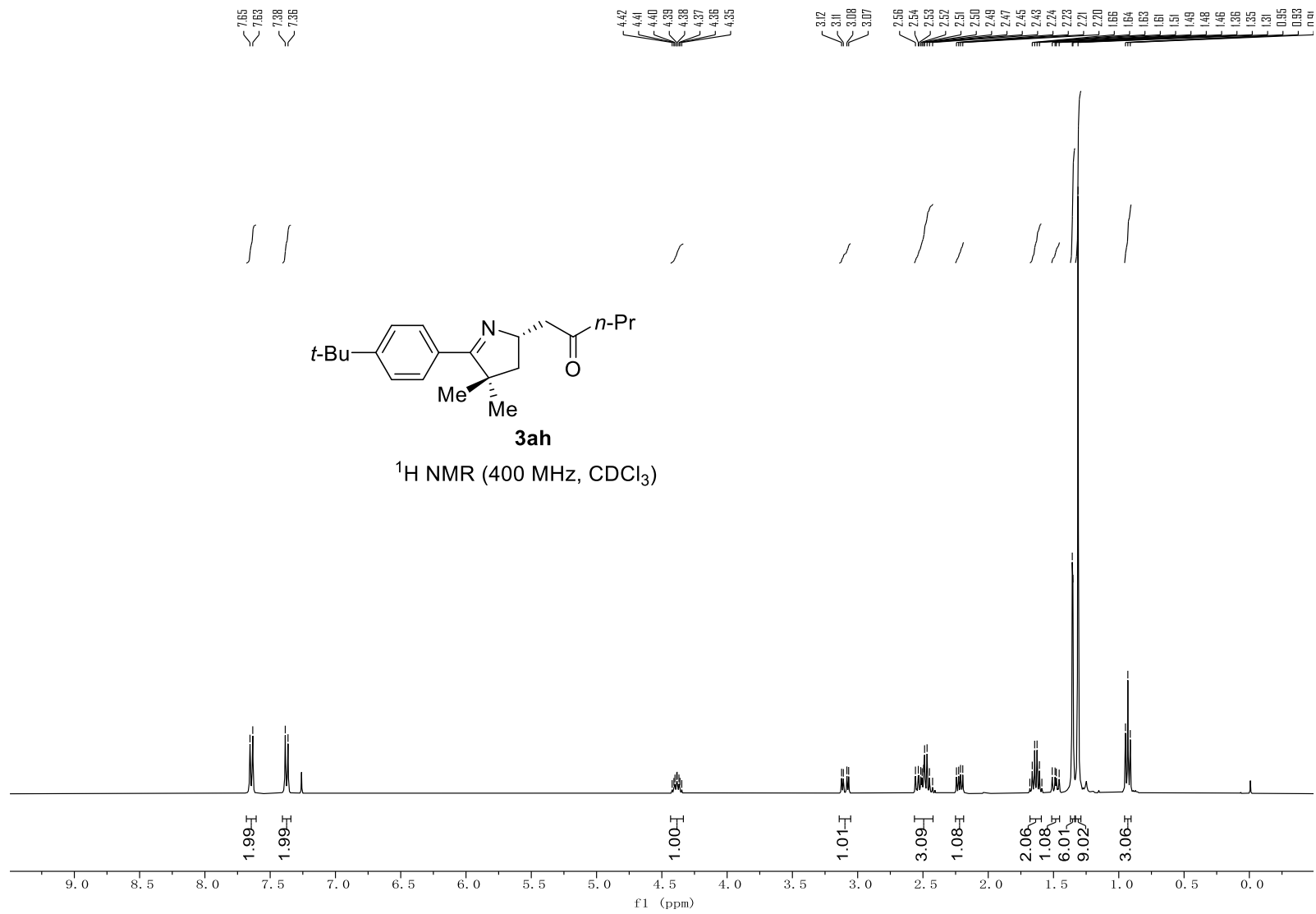


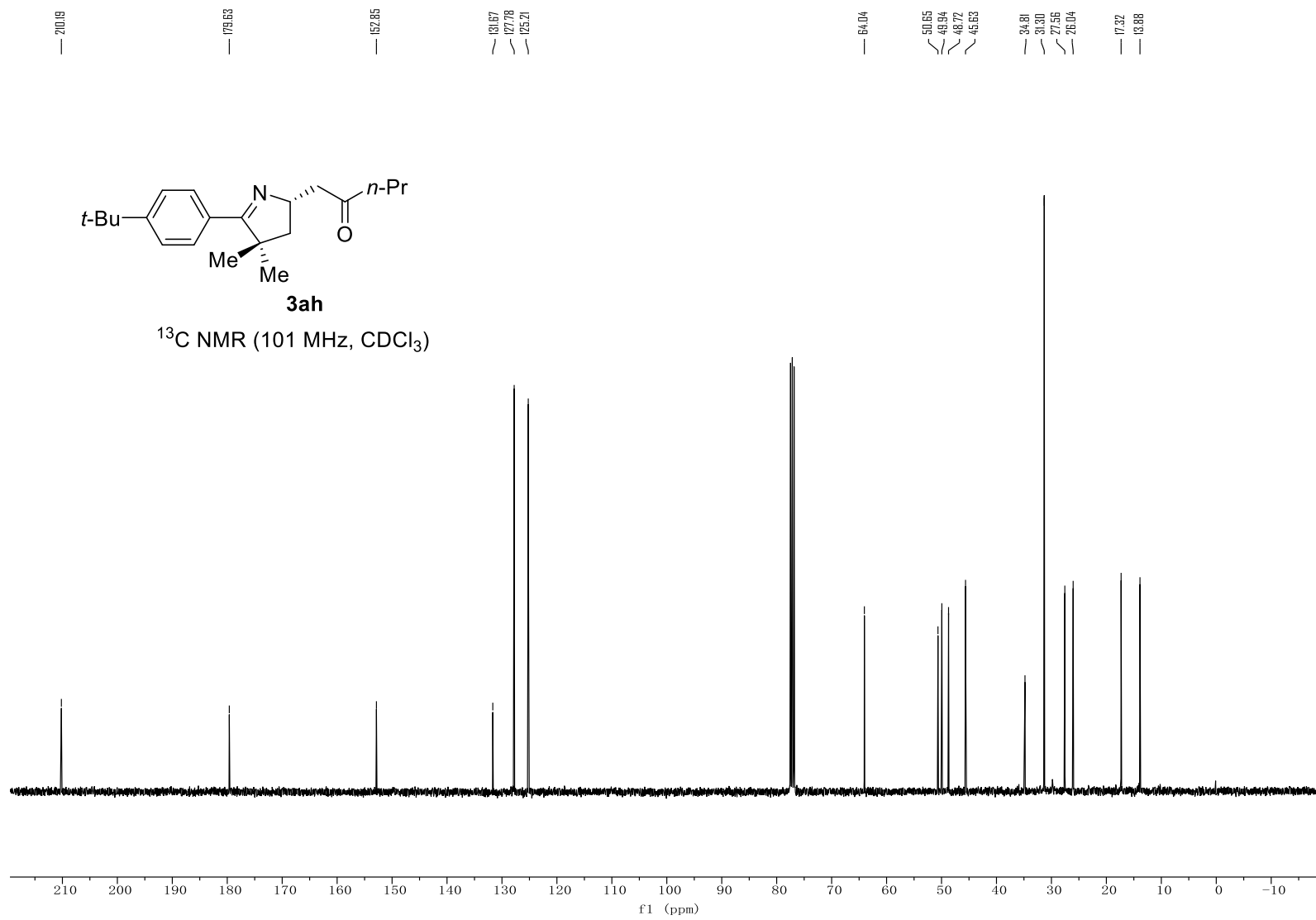


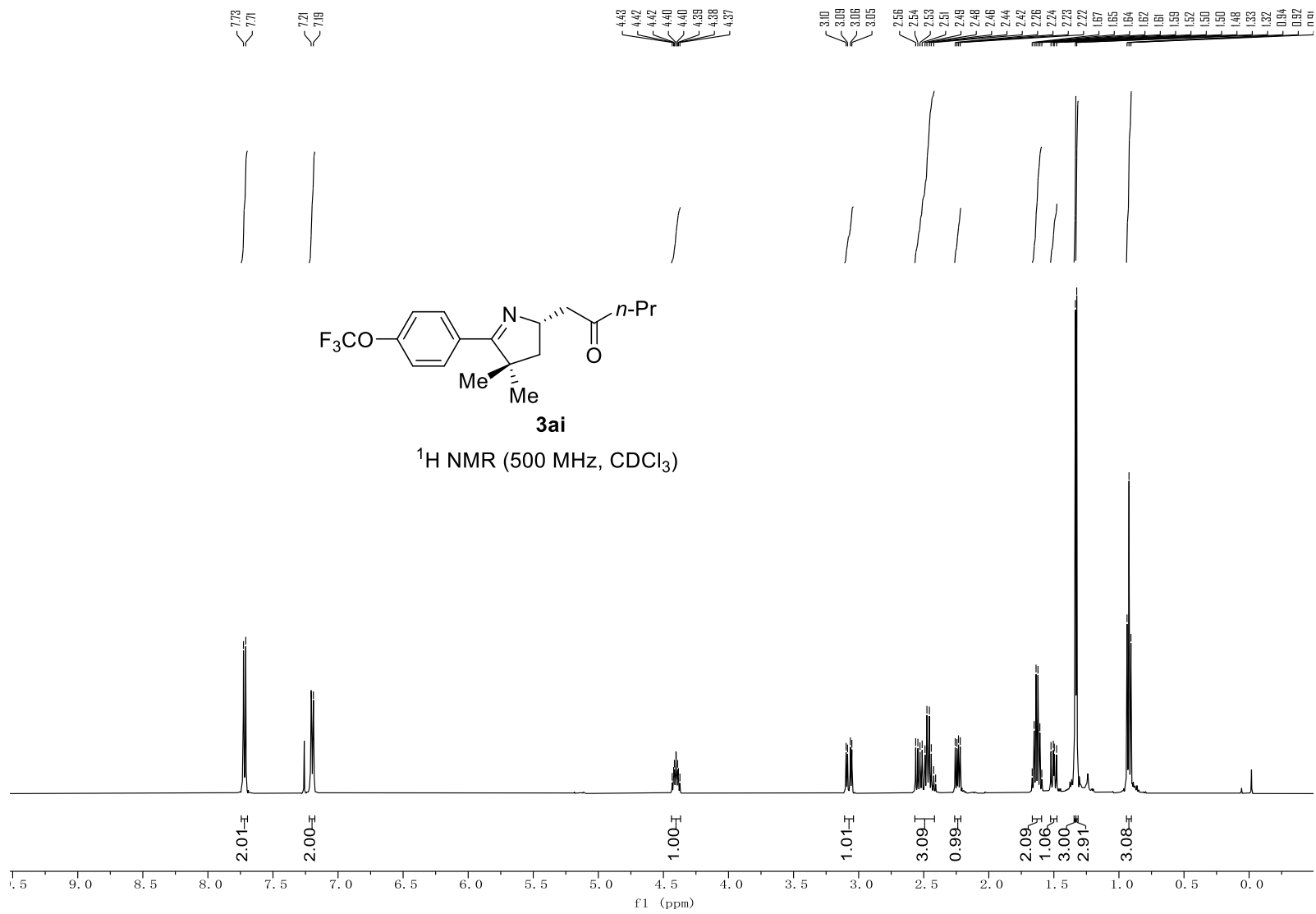


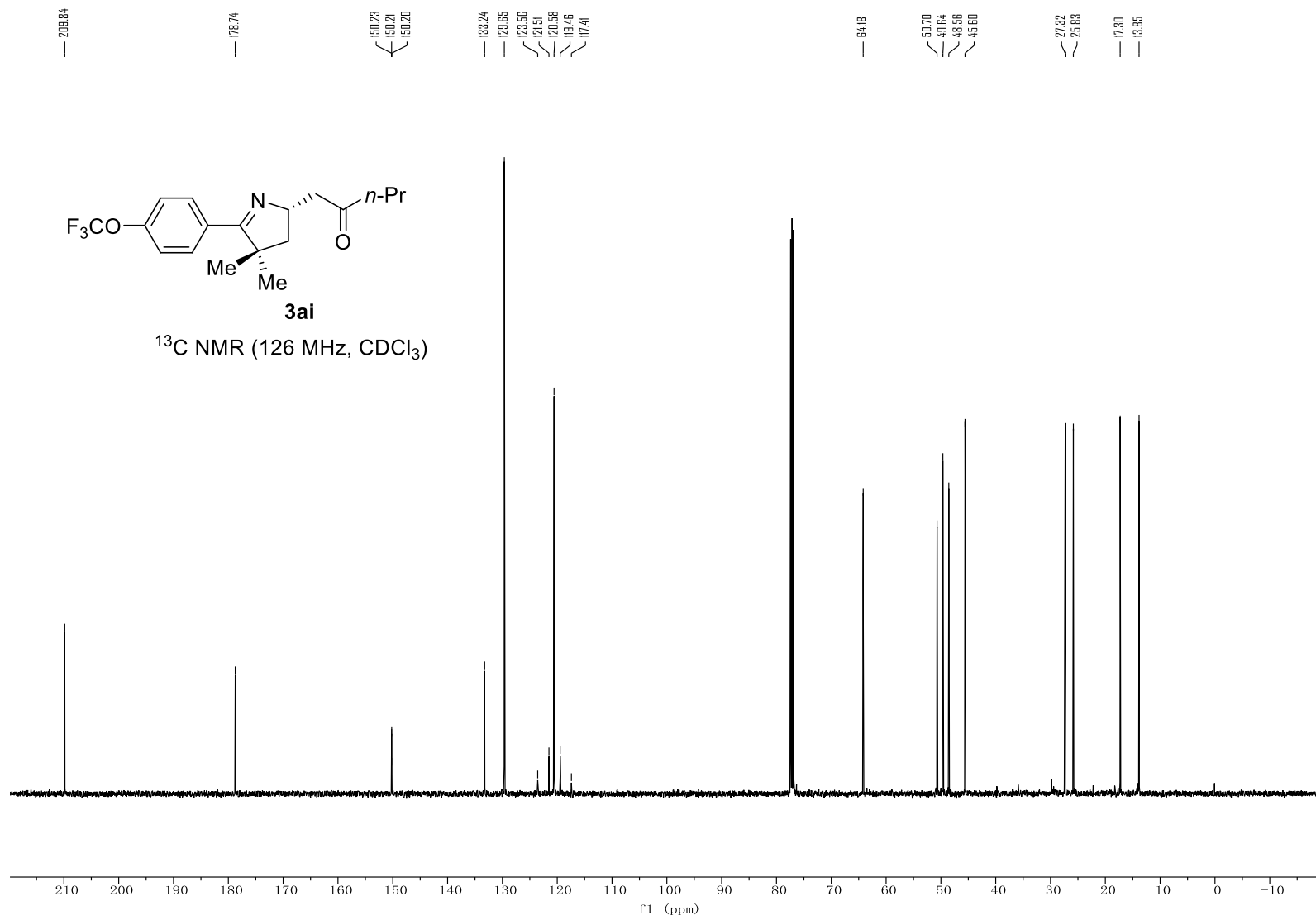


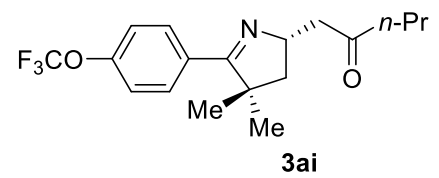




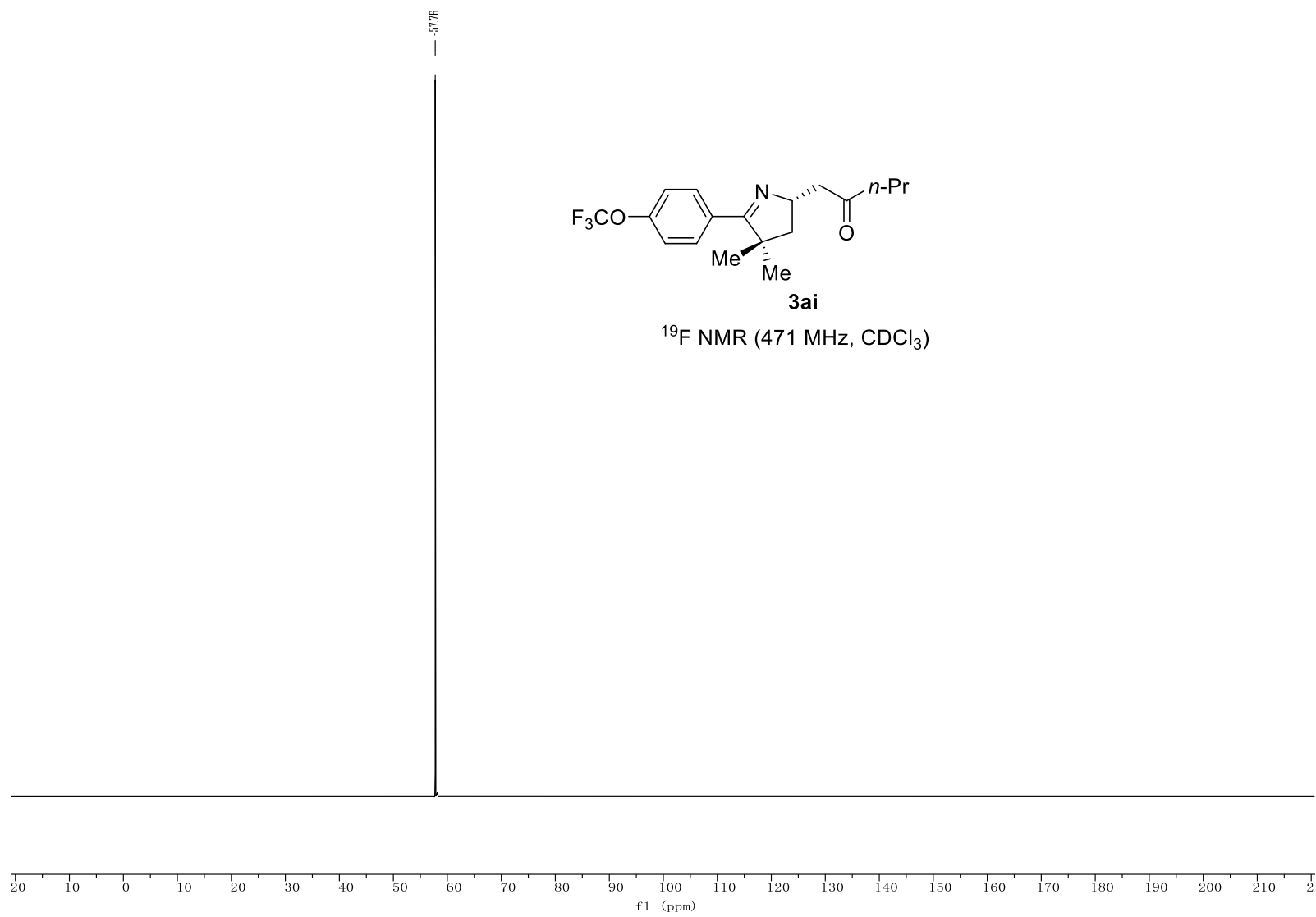


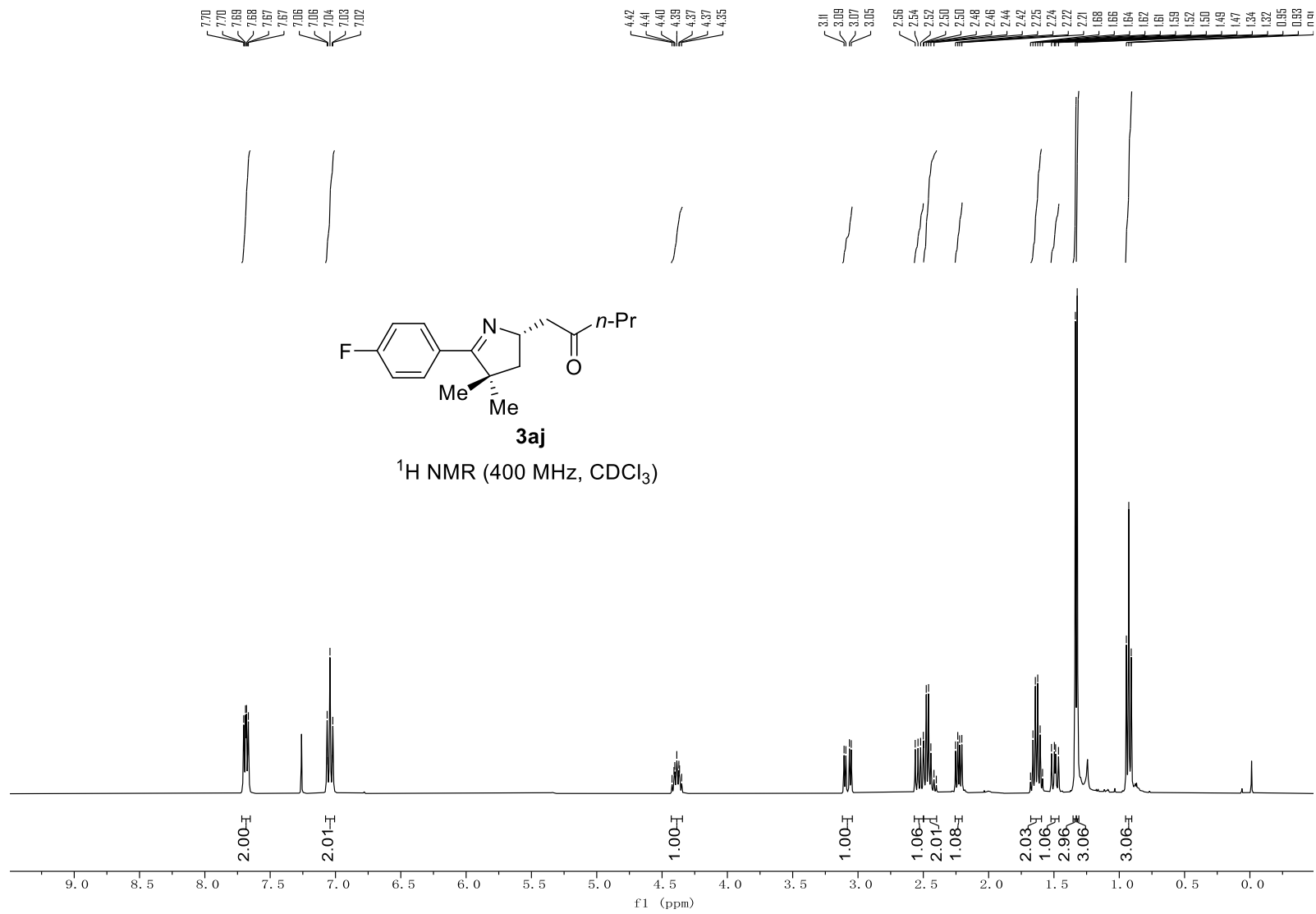


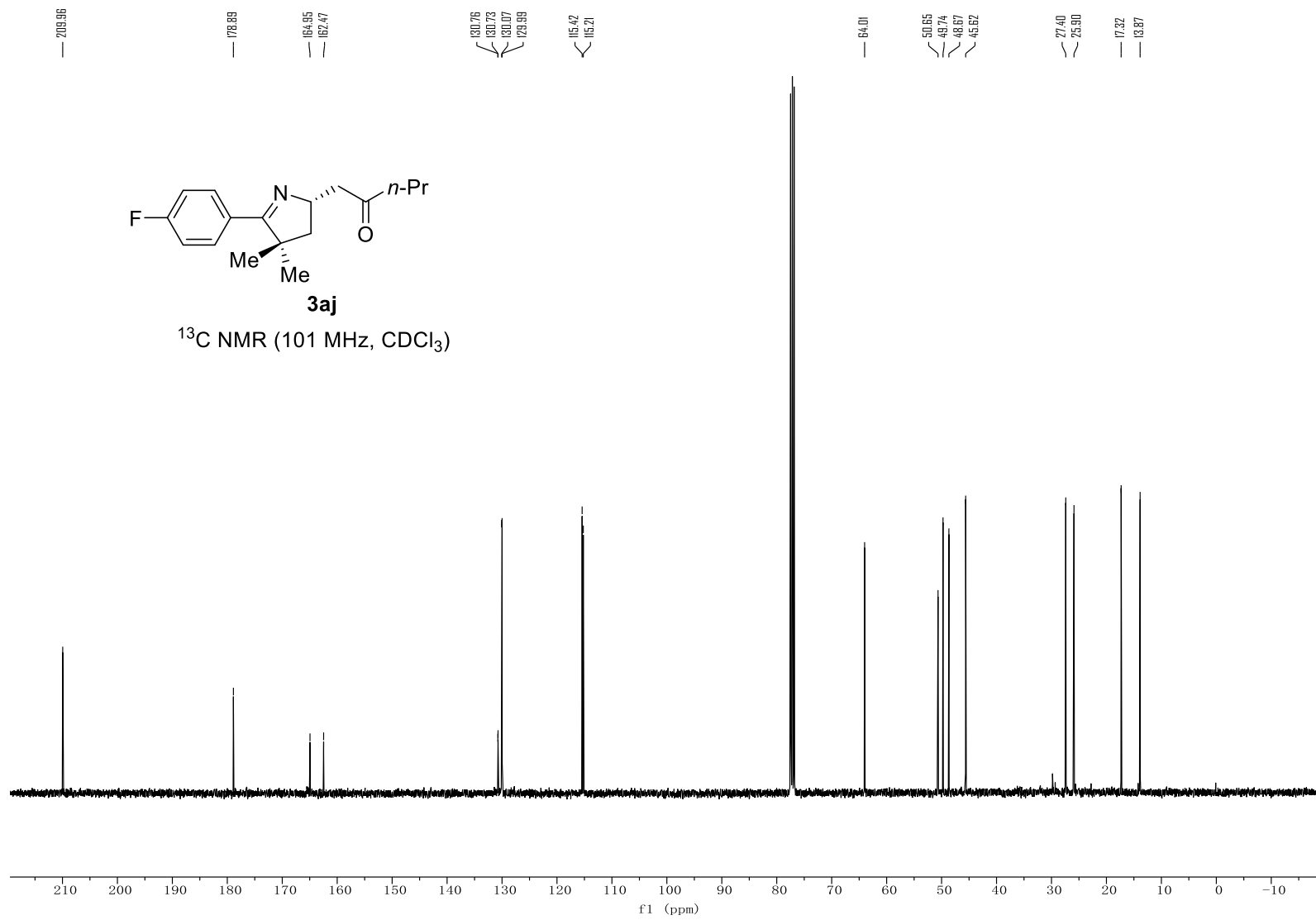


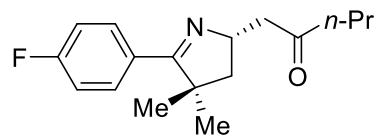


^{19}F NMR (471 MHz, CDCl_3)



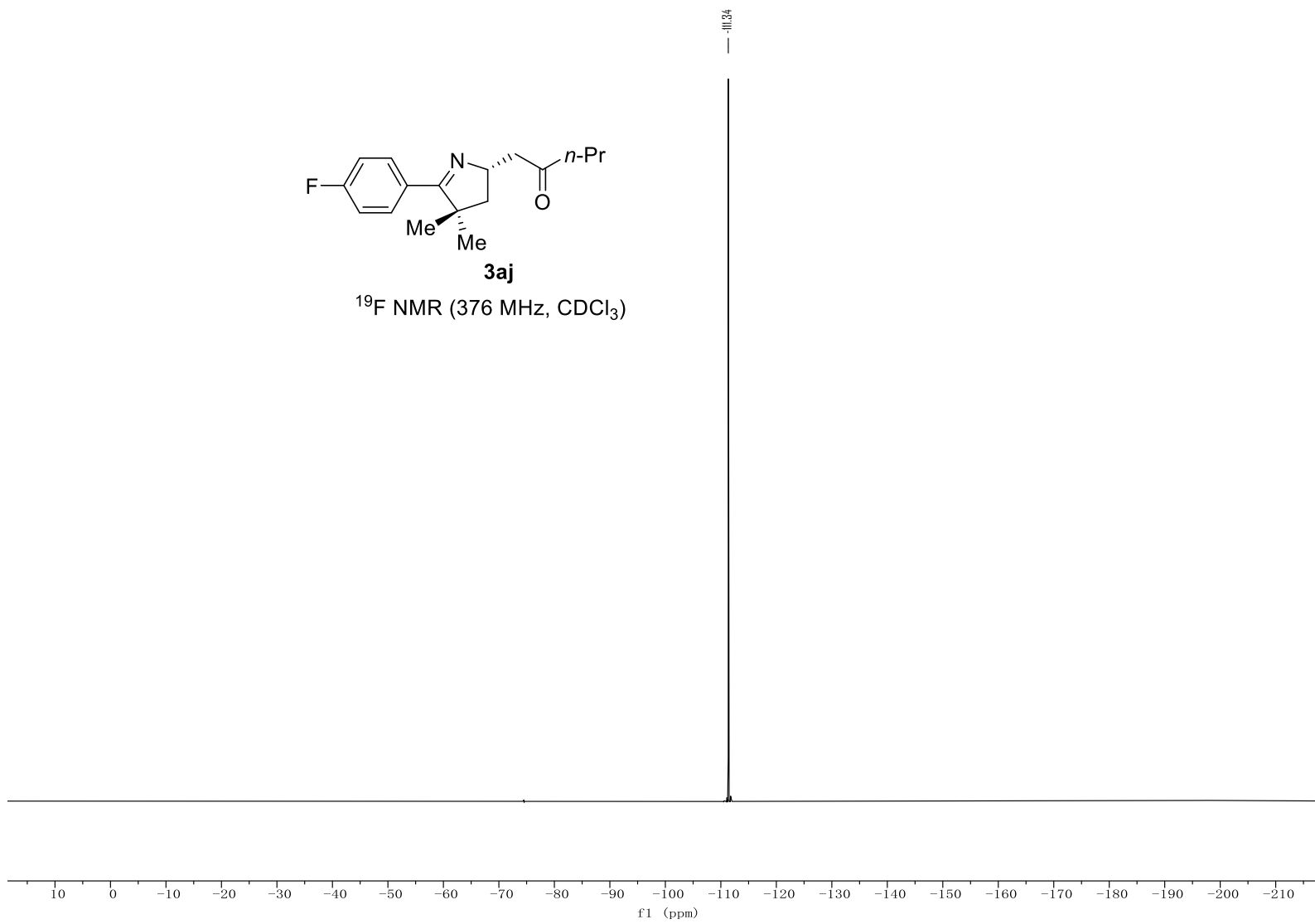


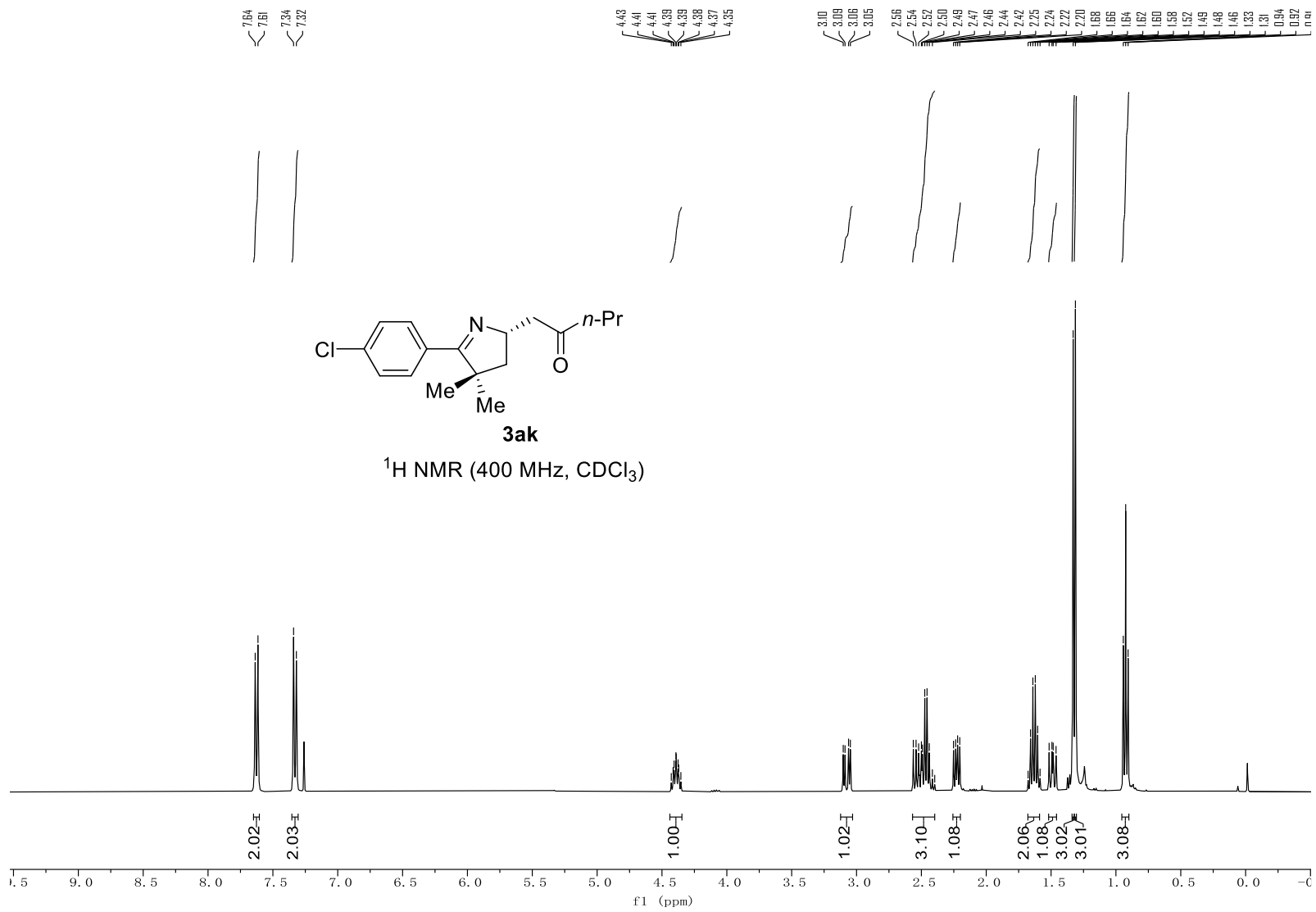


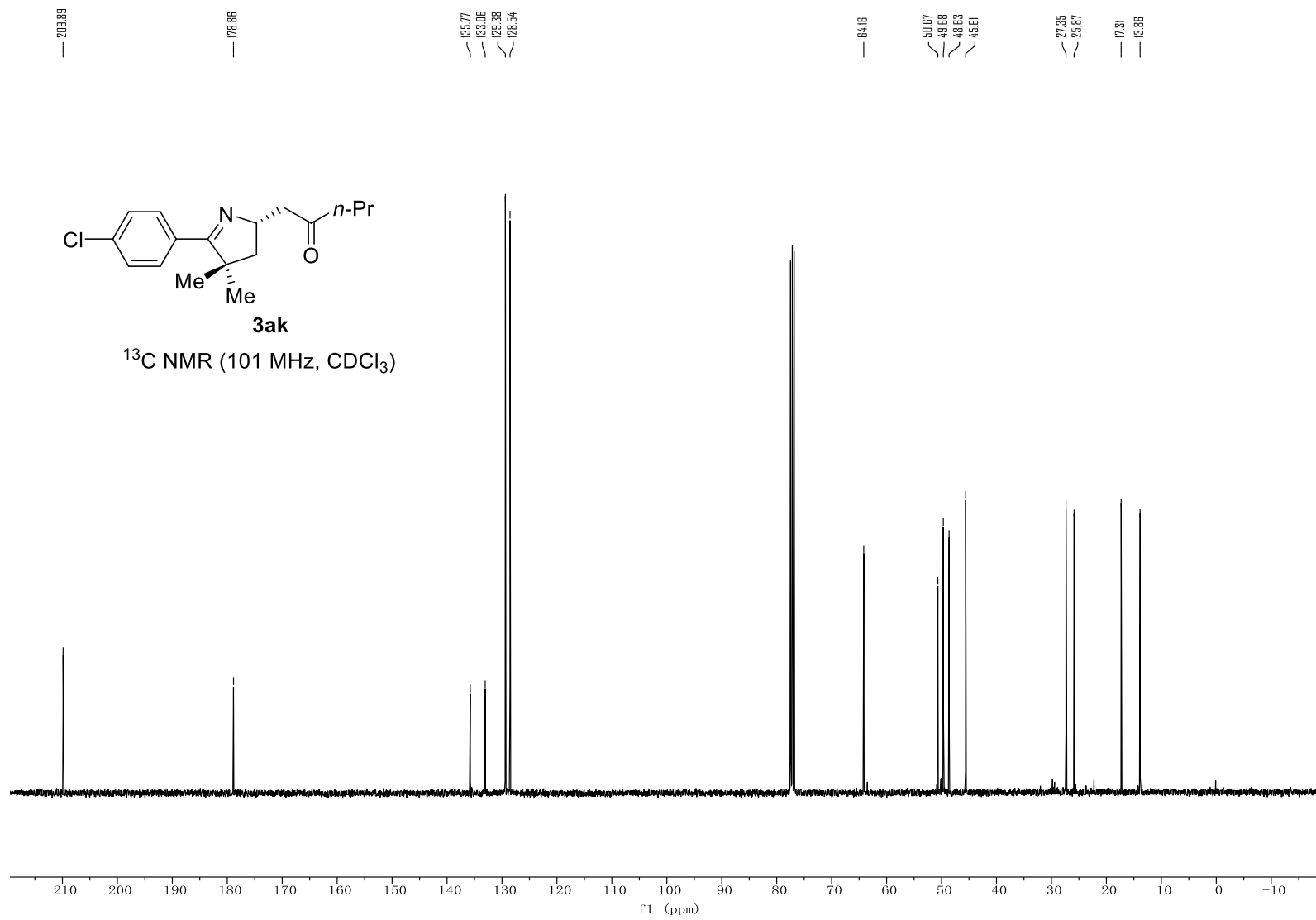


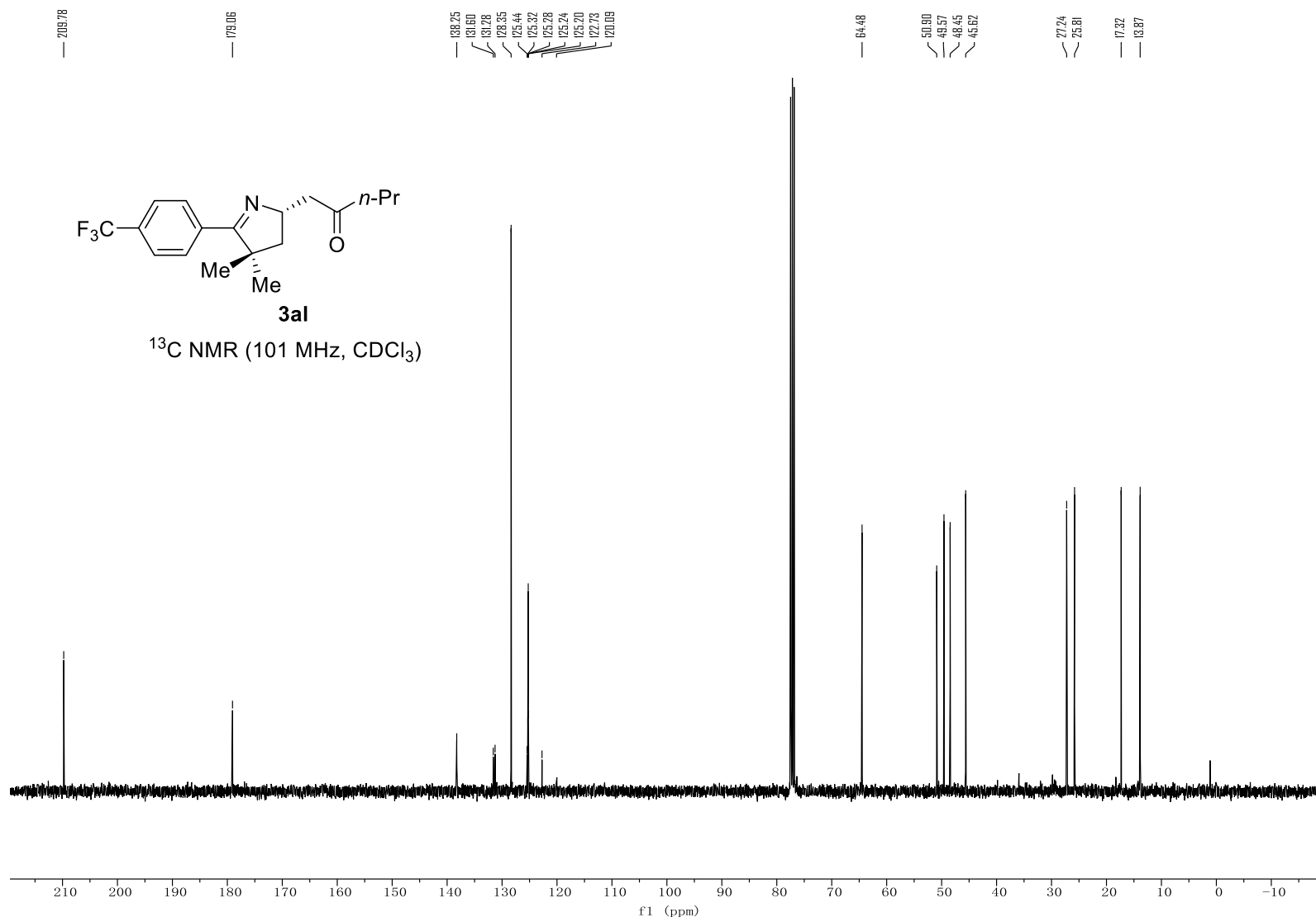
3aj

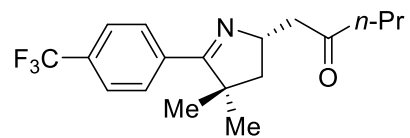
^{19}F NMR (376 MHz, CDCl_3)





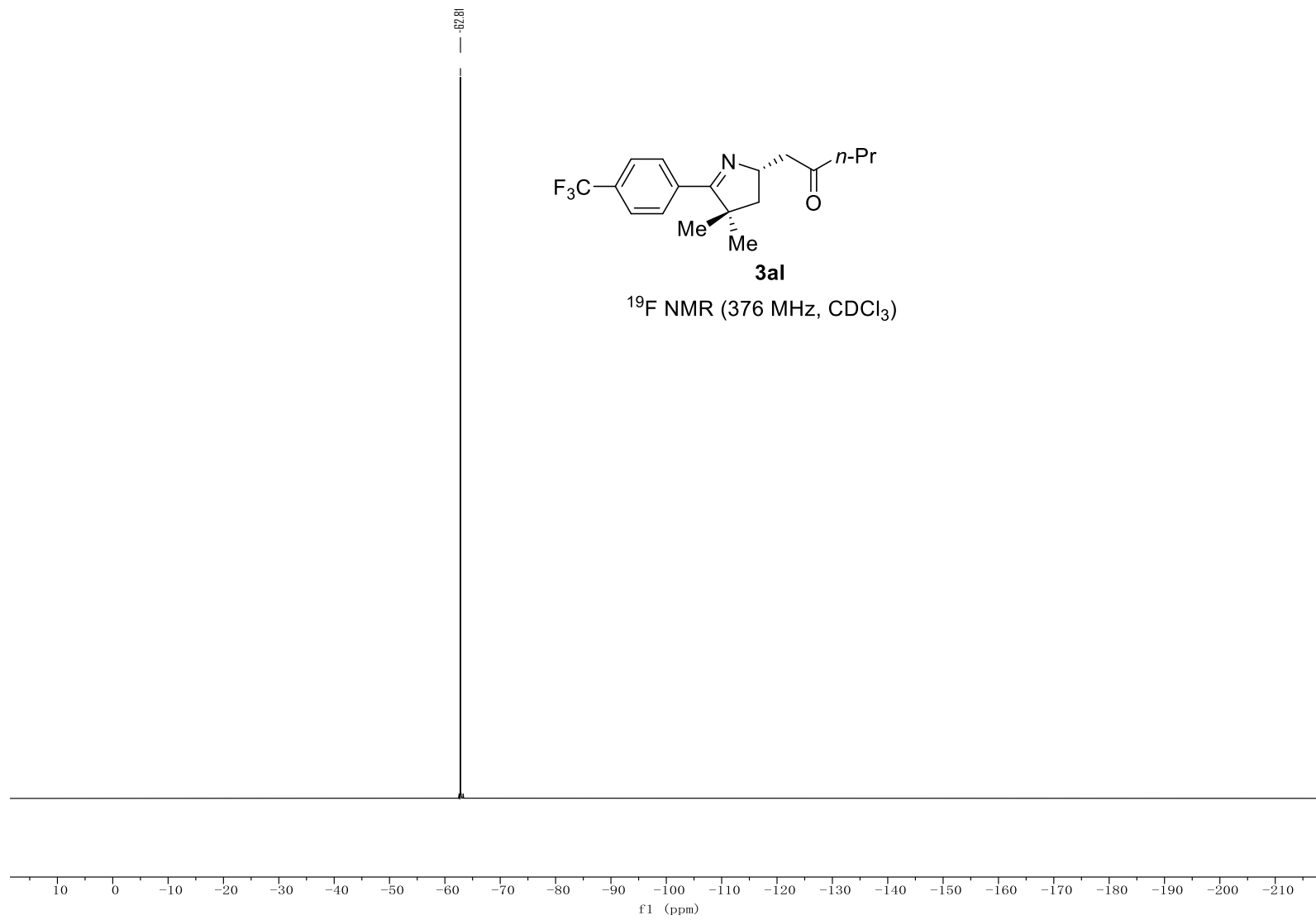


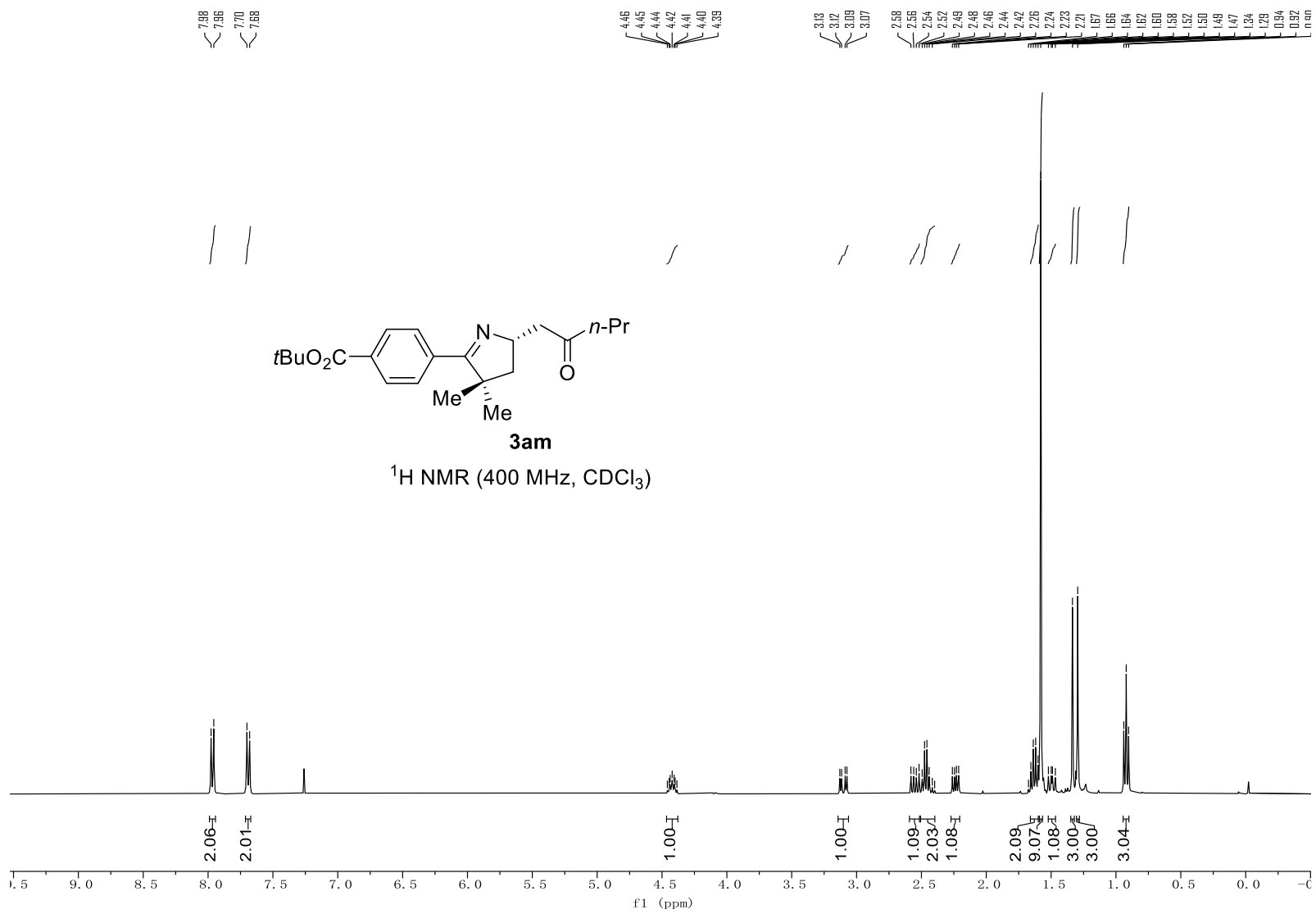


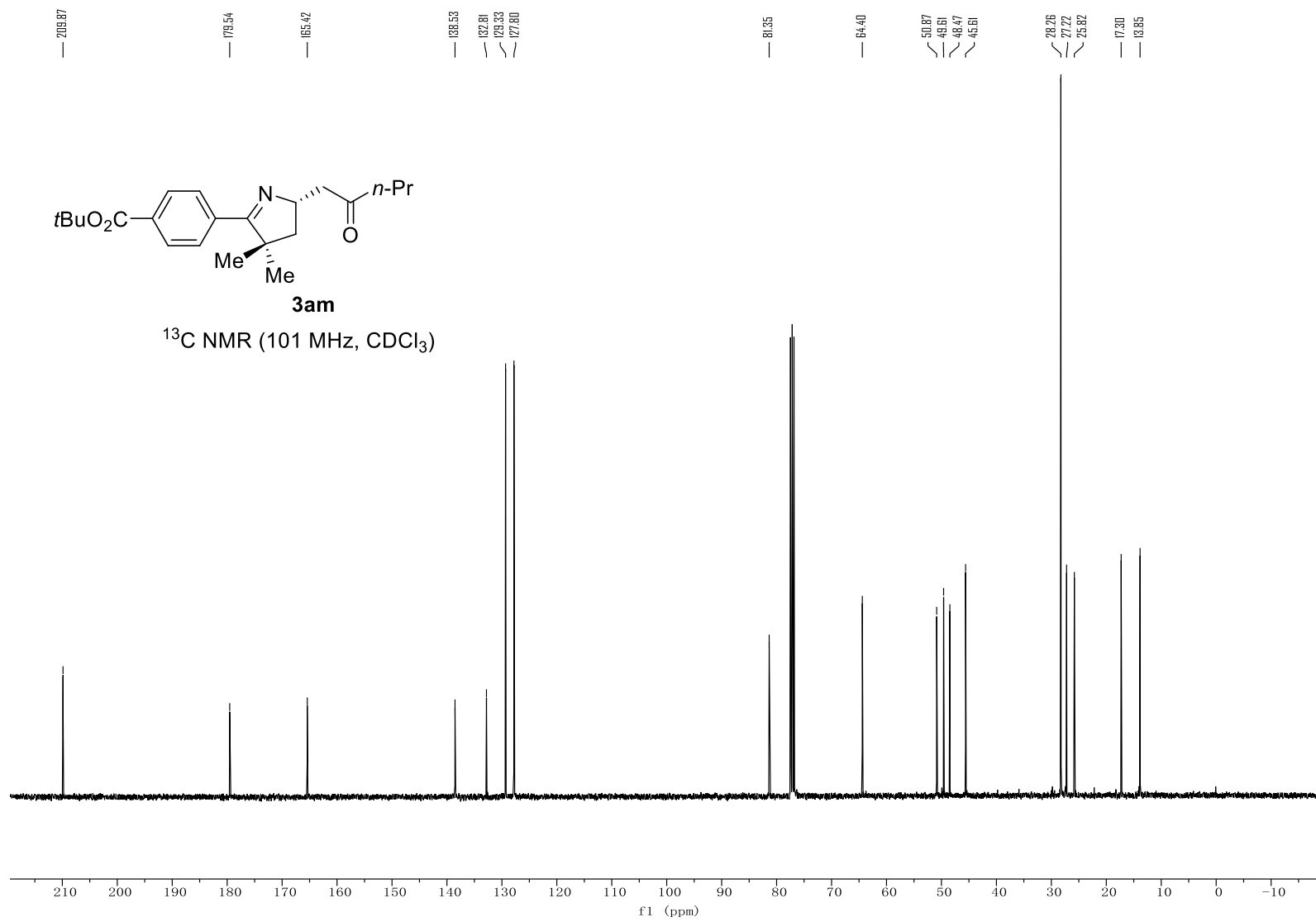


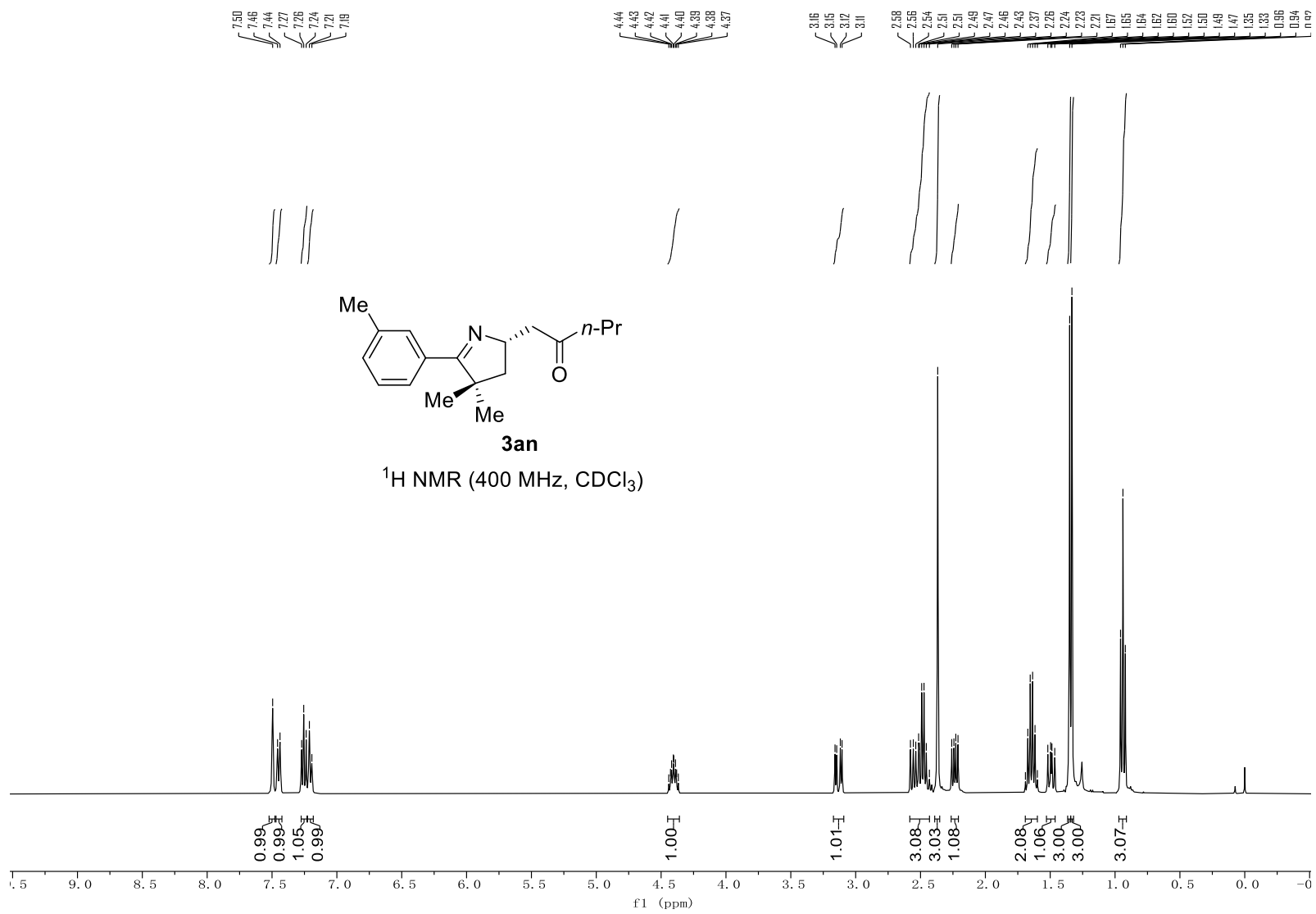
3al

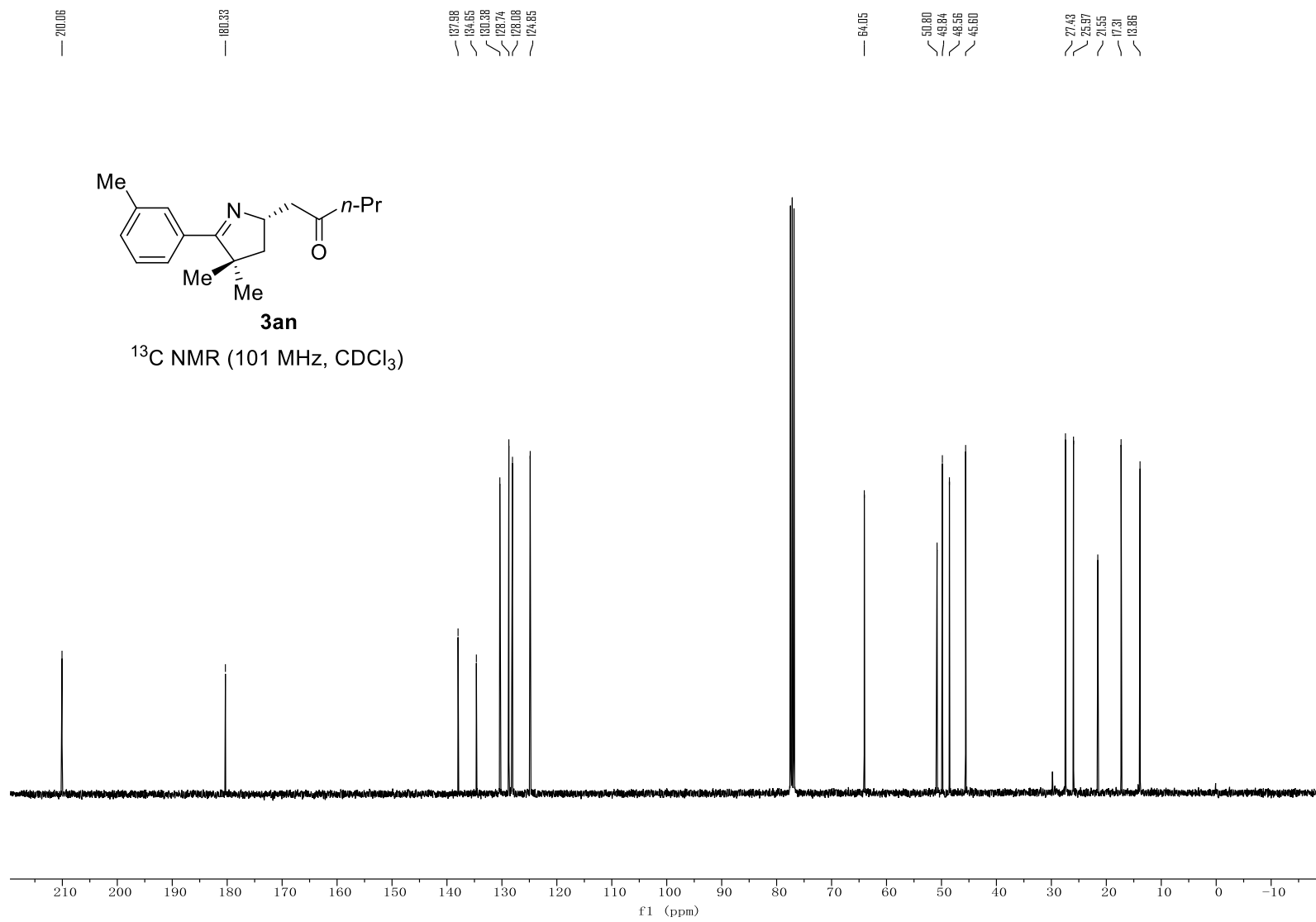
¹⁹F NMR (376 MHz, CDCl₃)

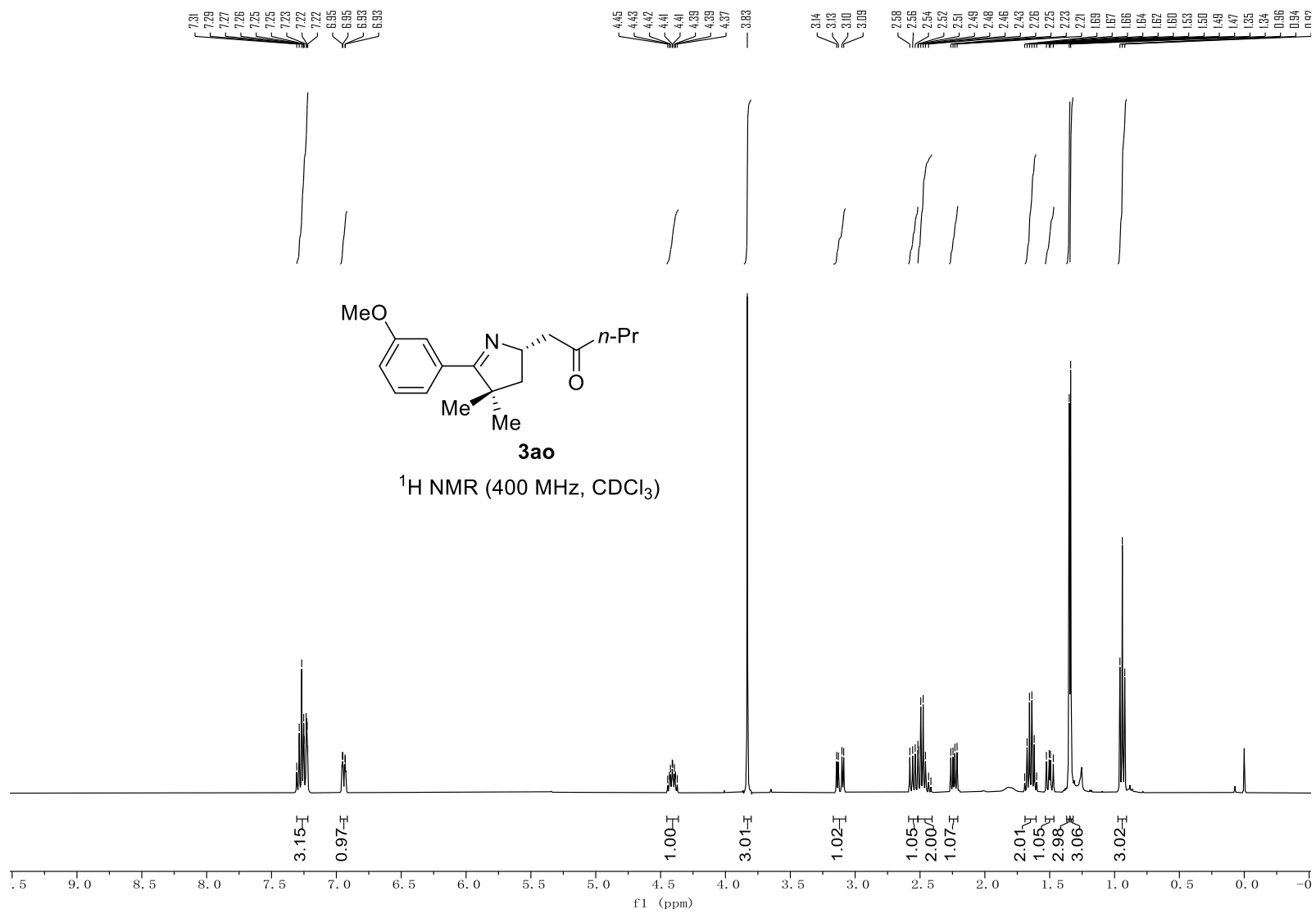


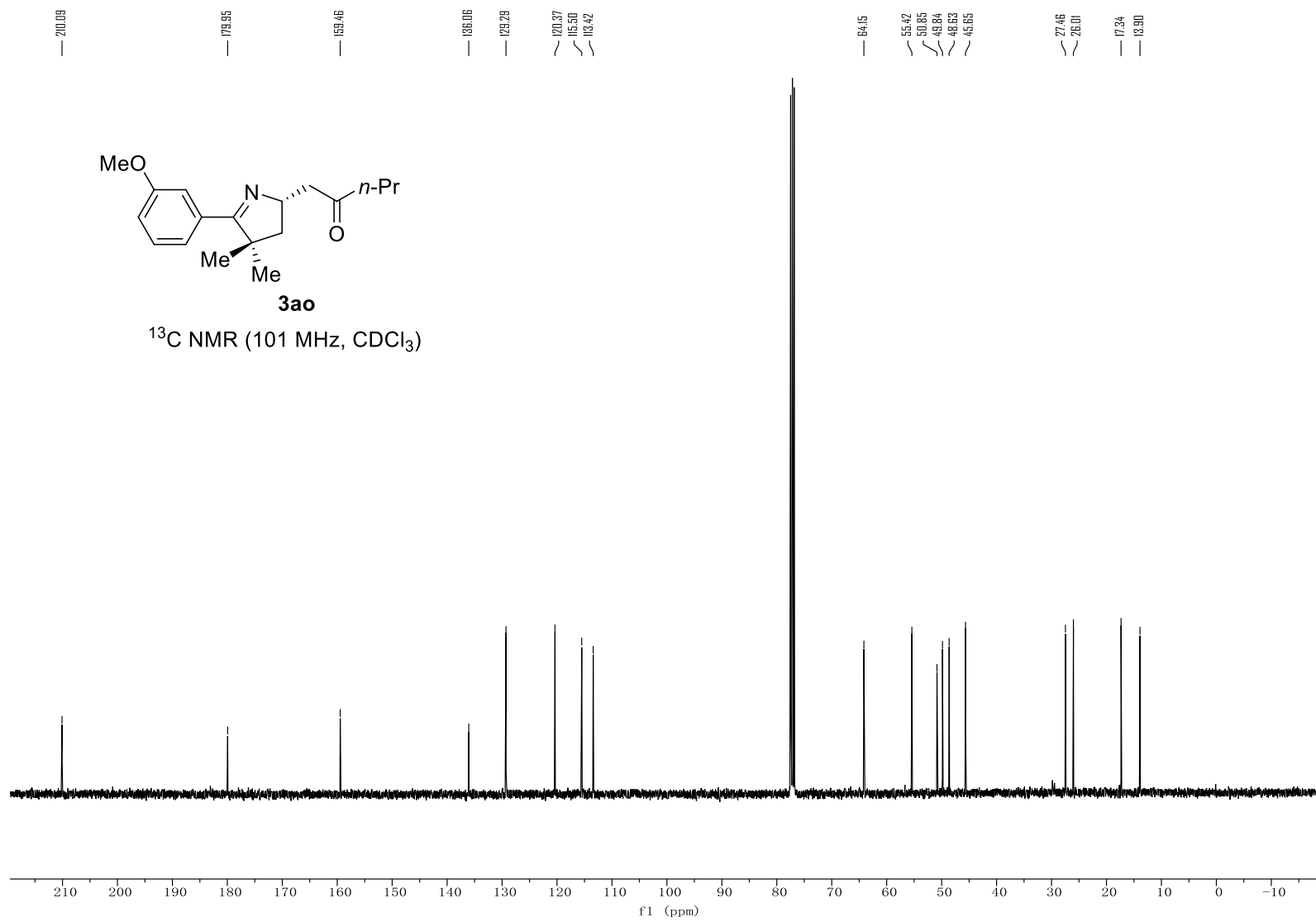


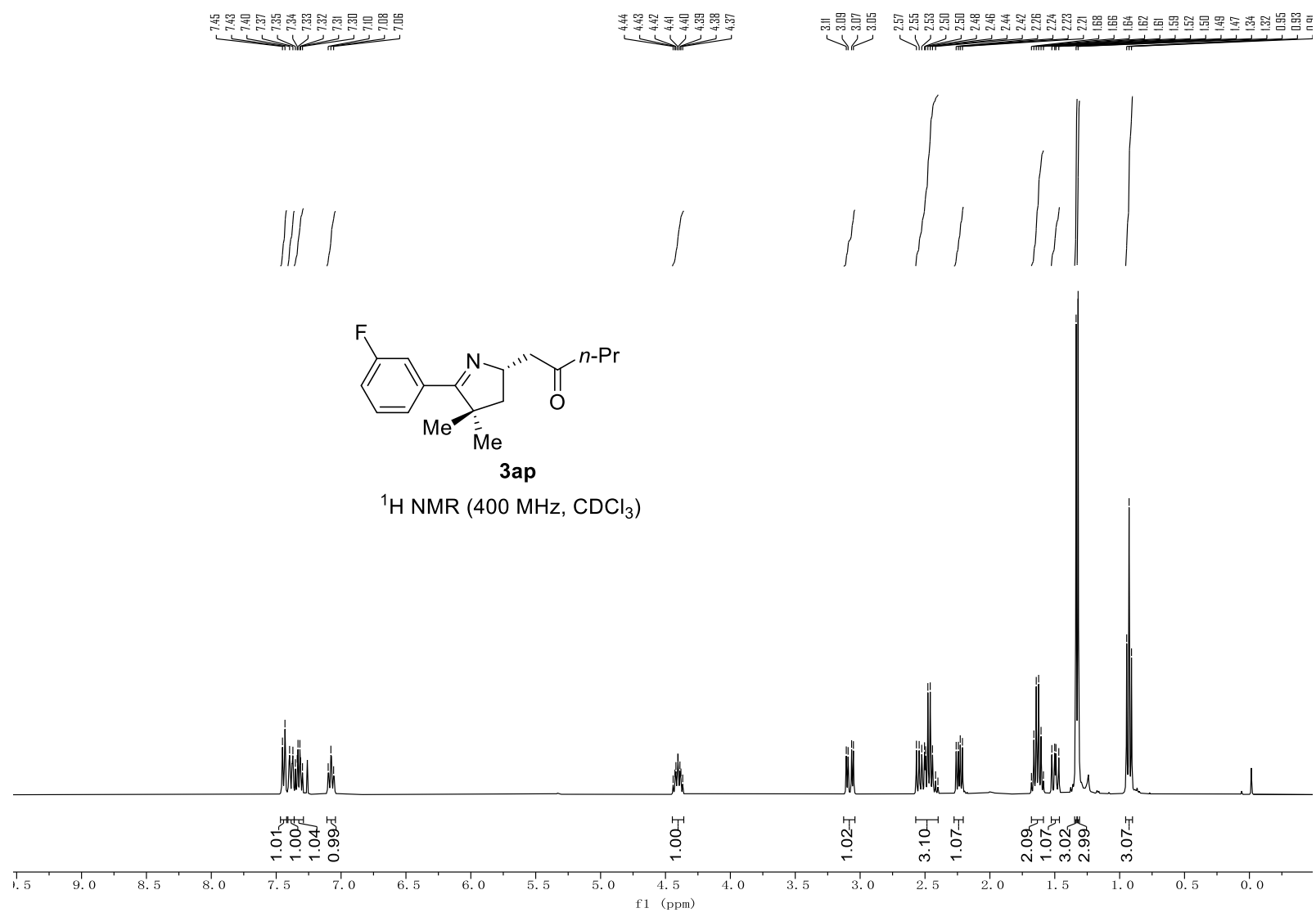


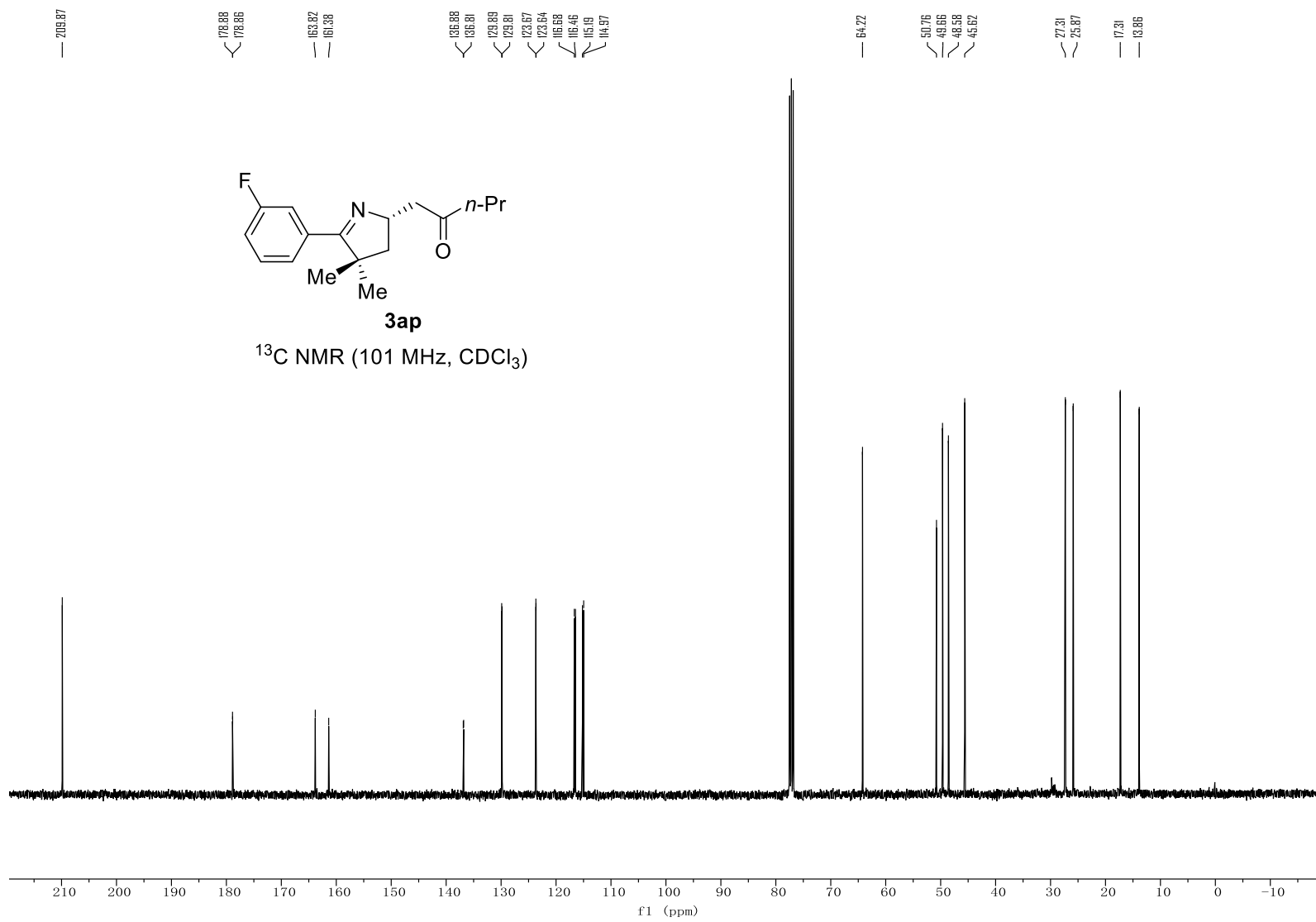


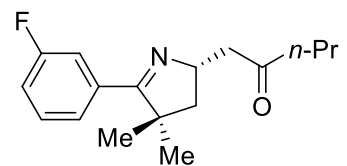






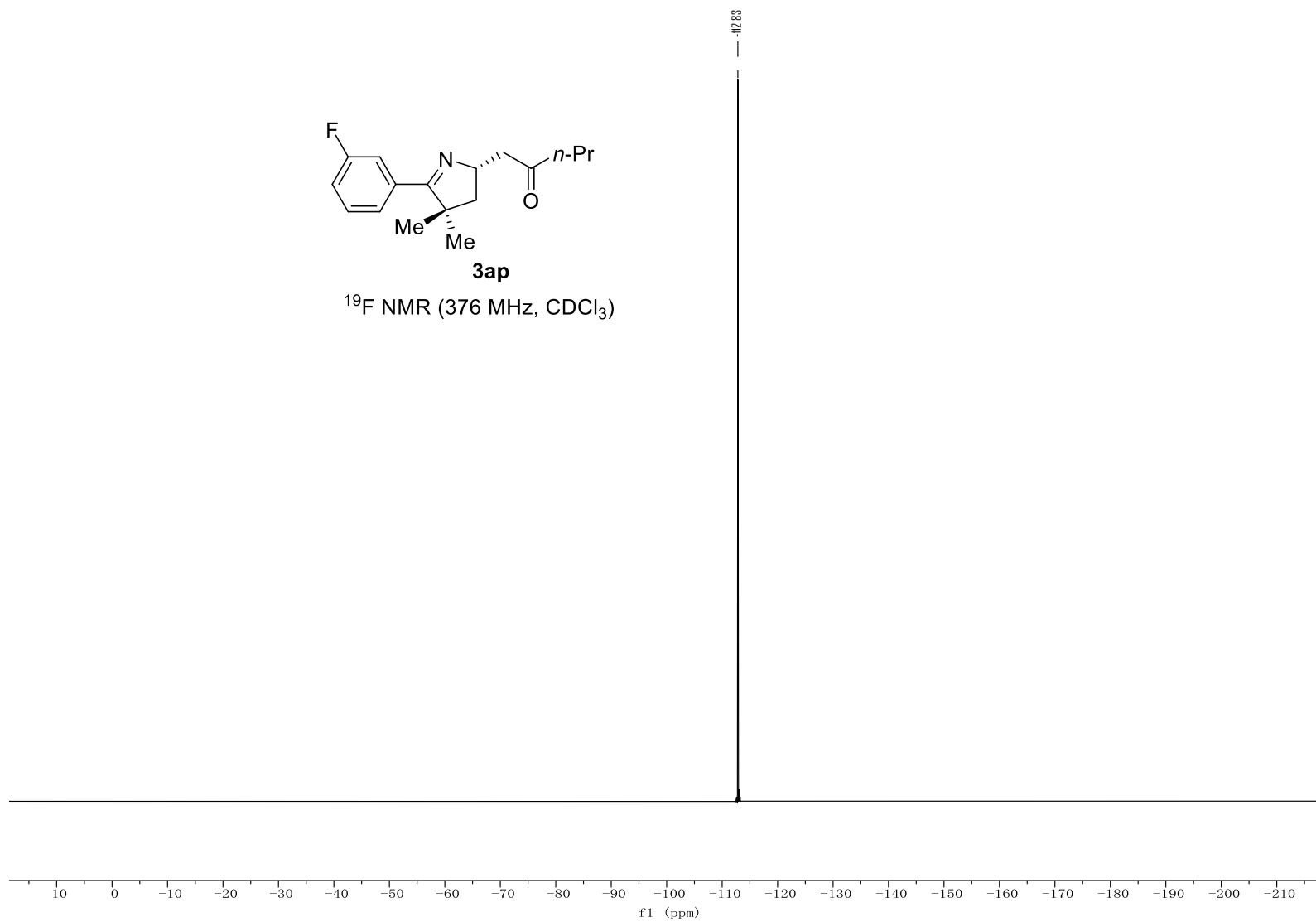


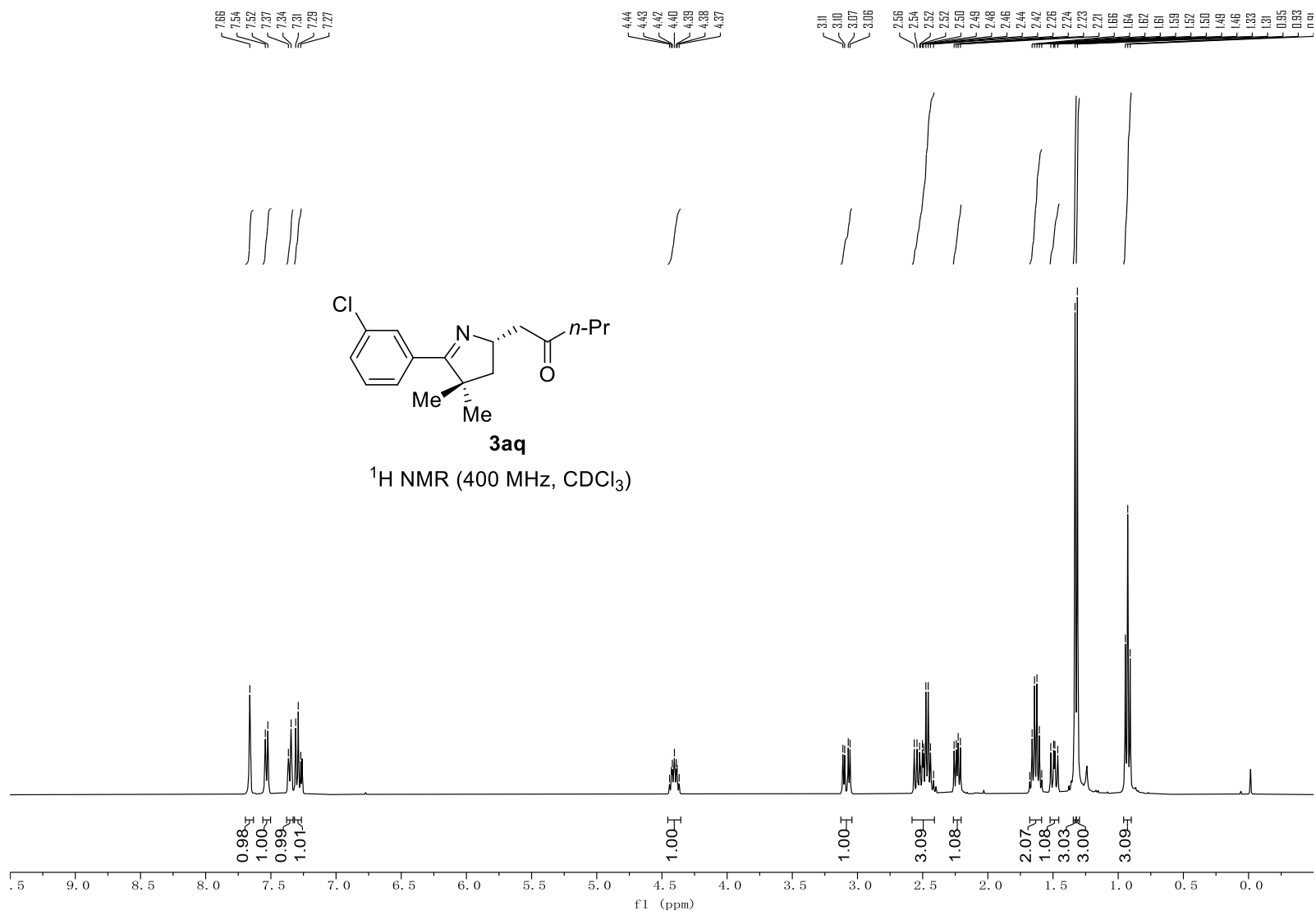


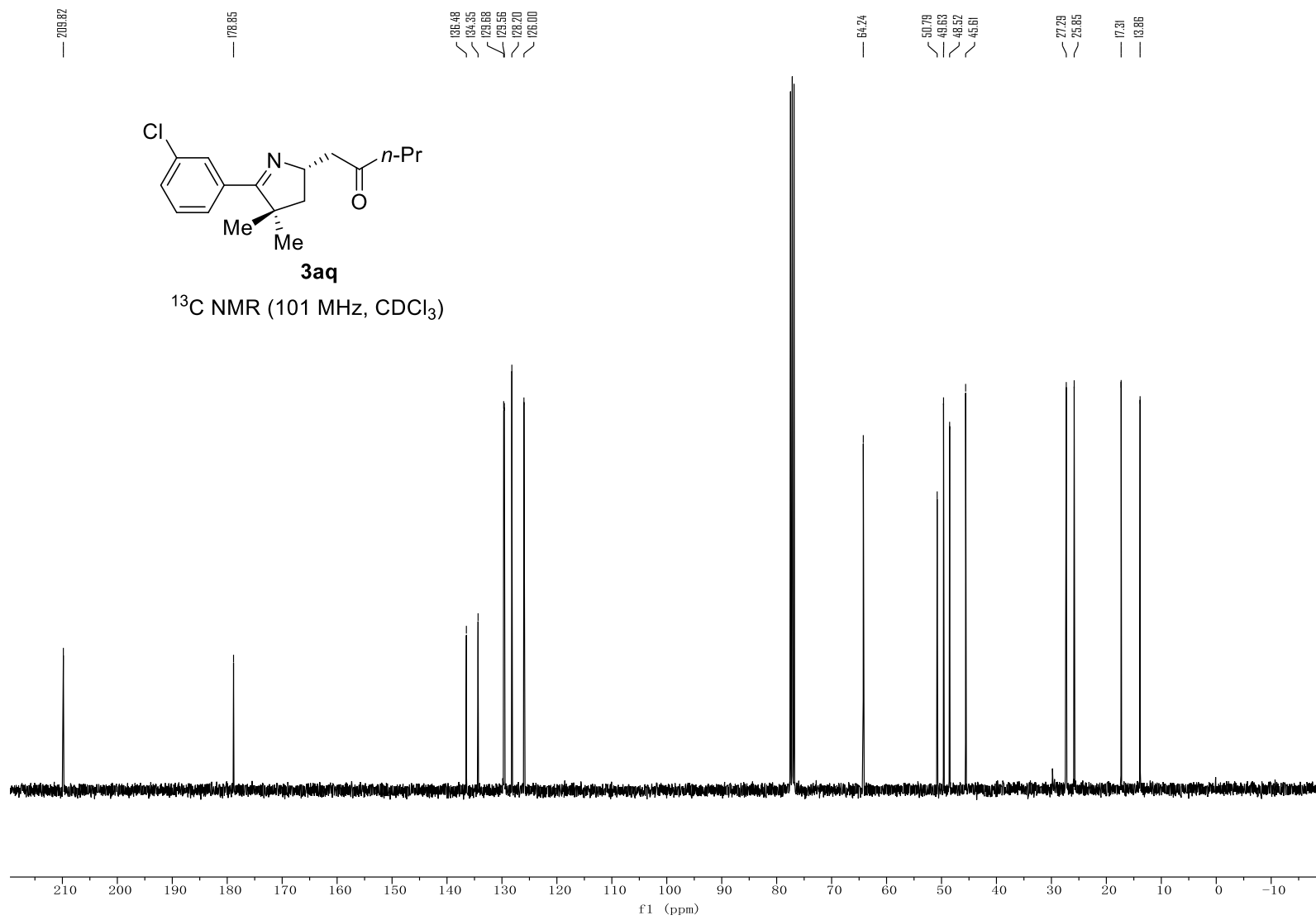


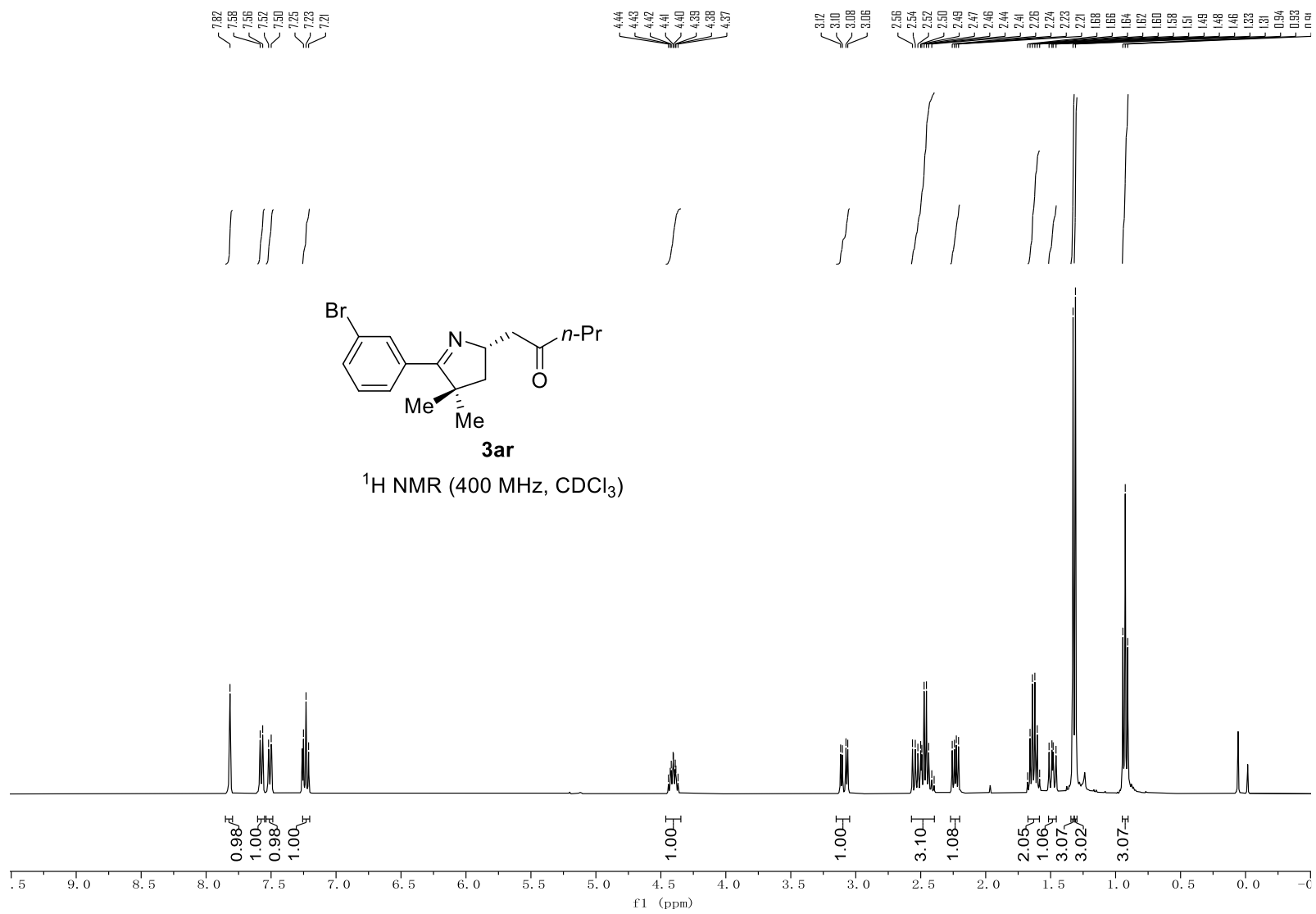
3ap

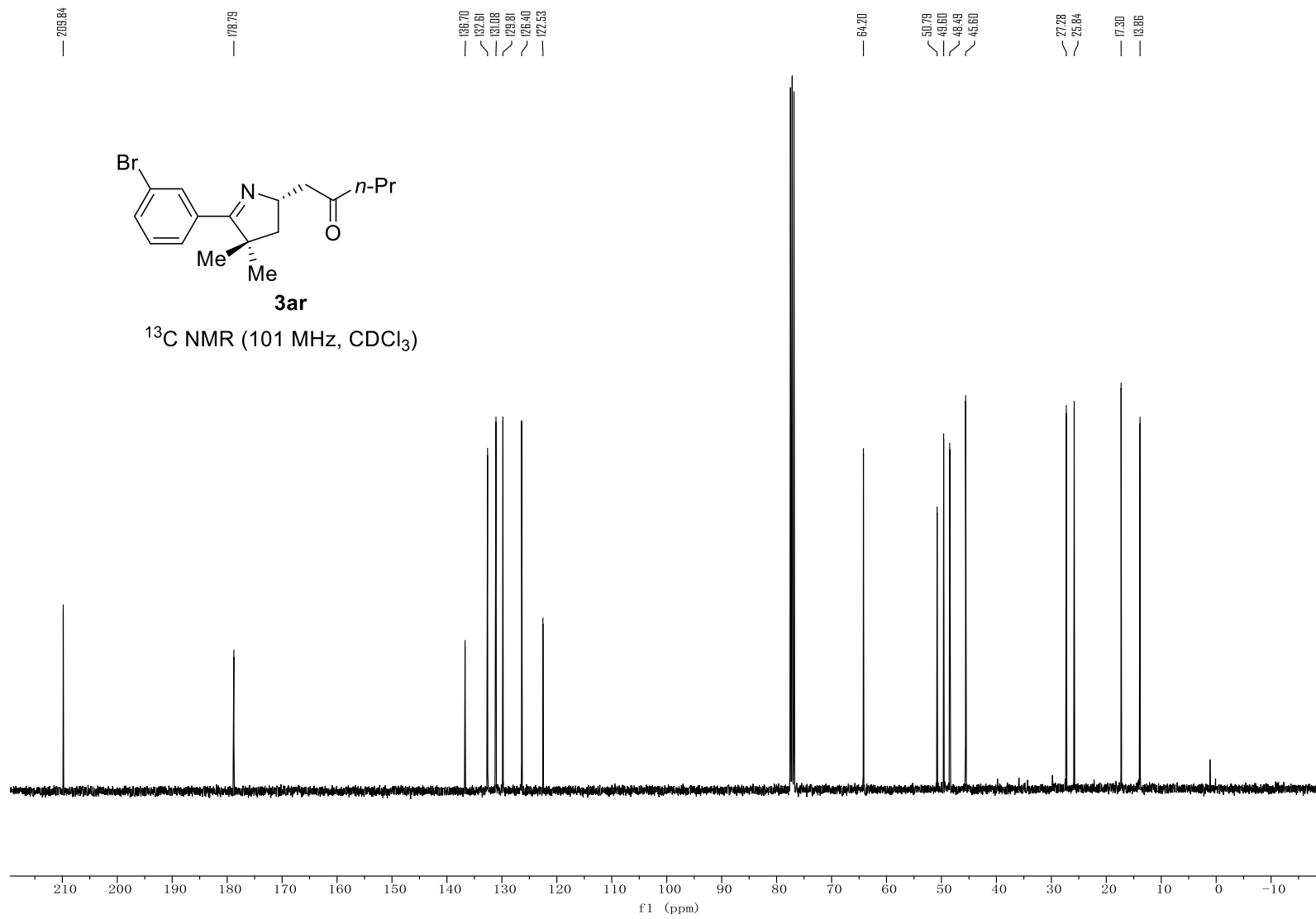
^{19}F NMR (376 MHz, CDCl_3)

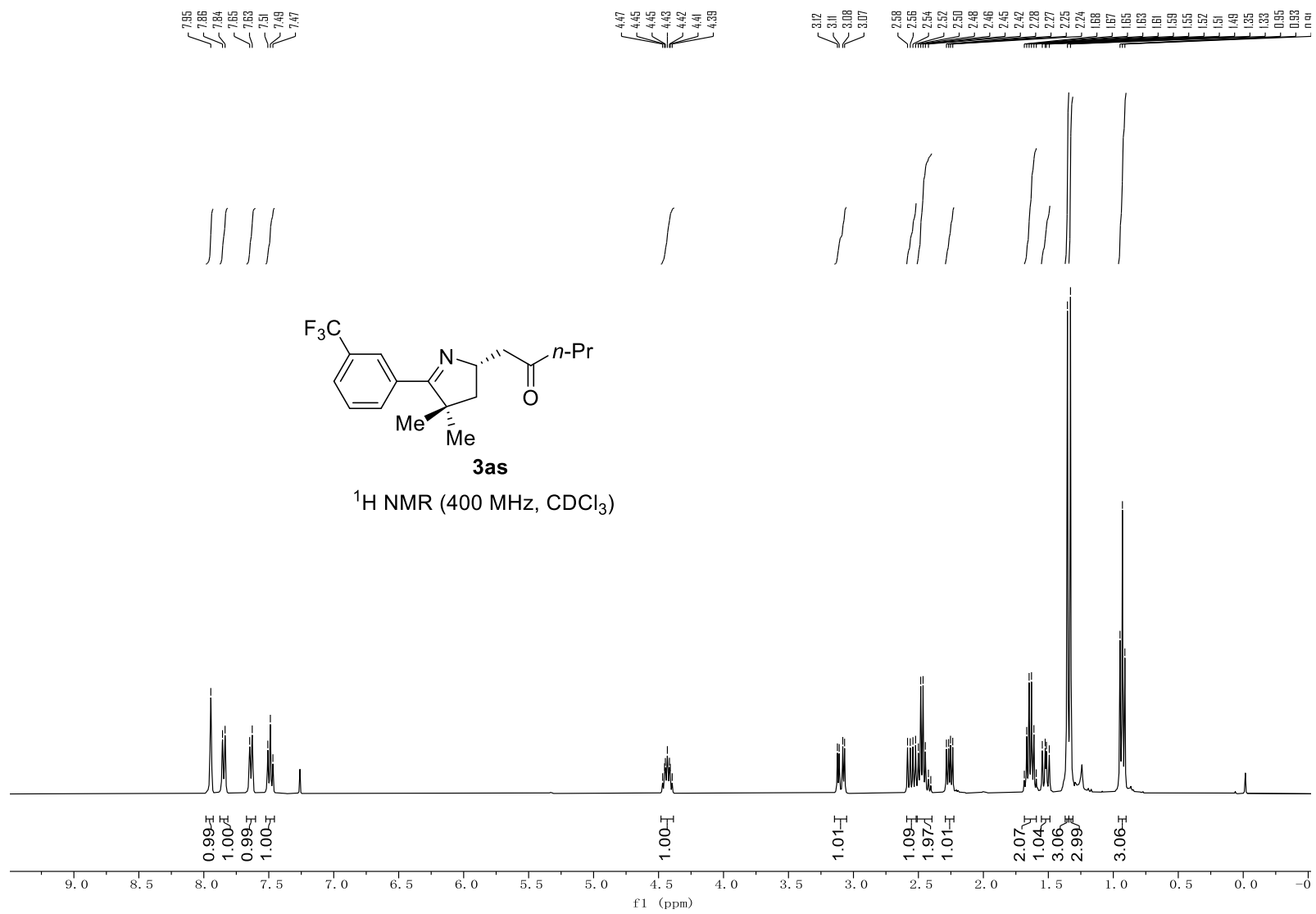


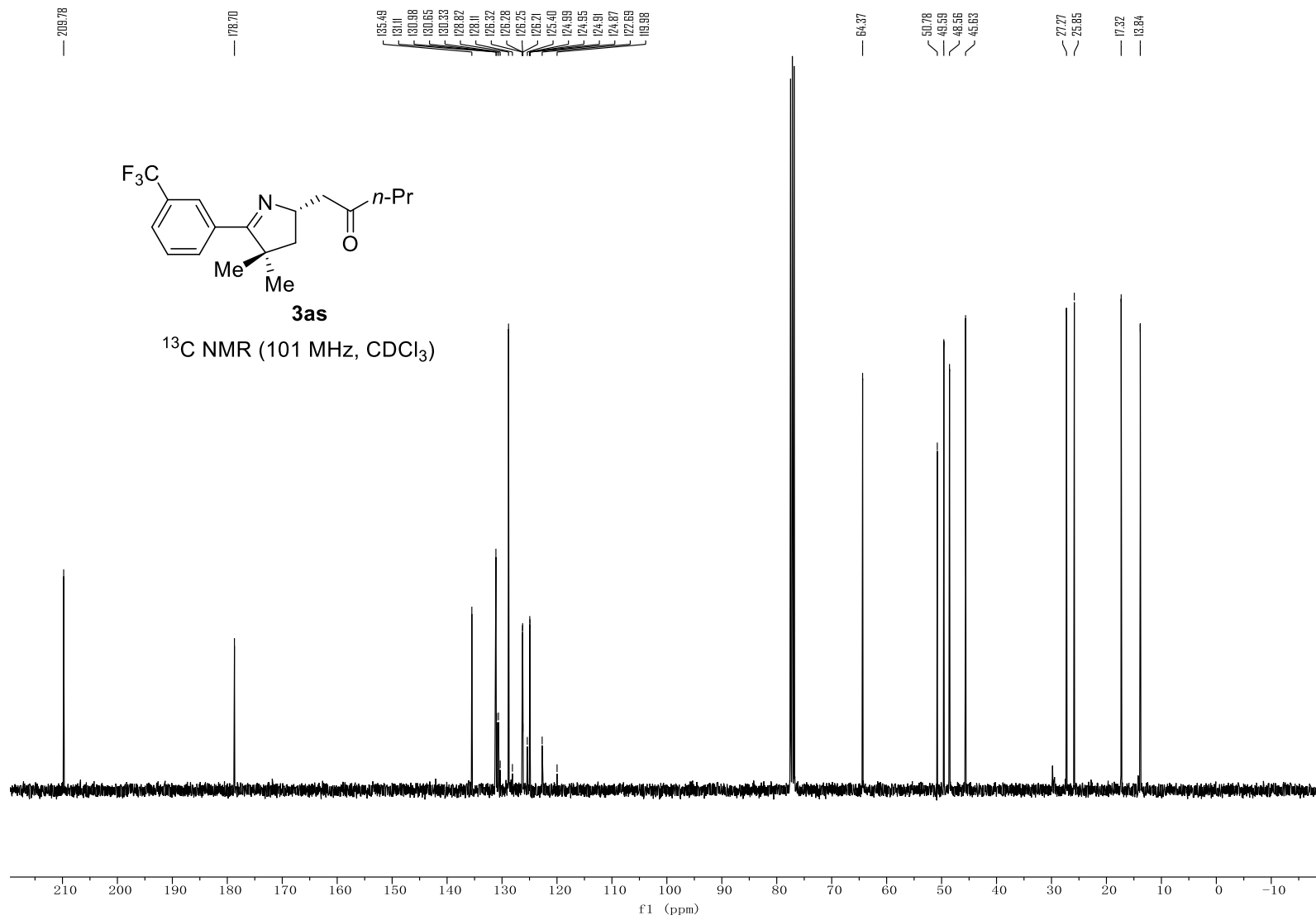


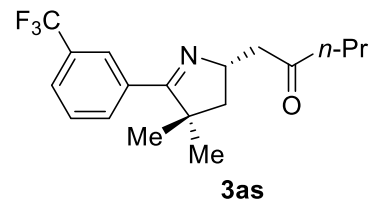




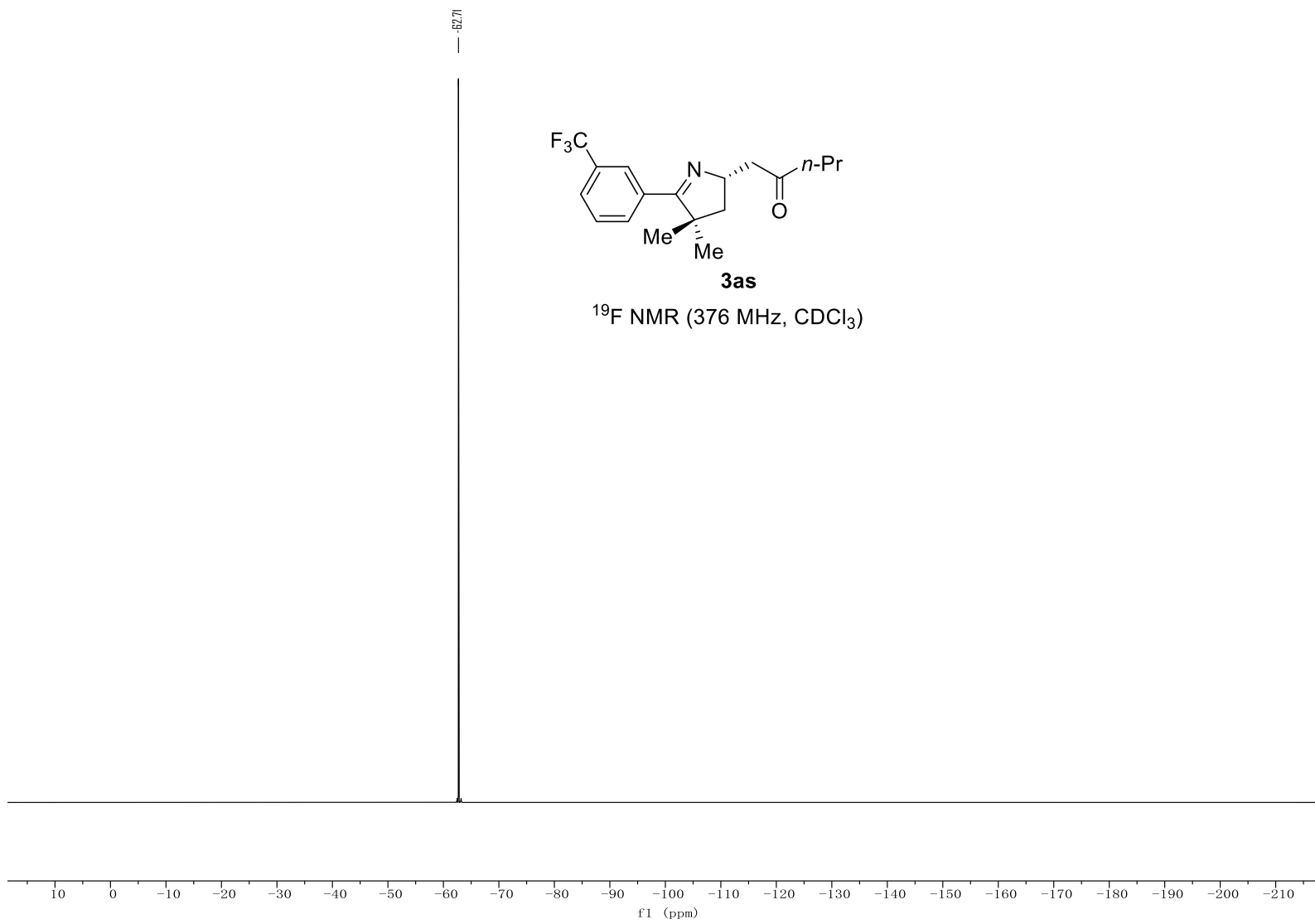


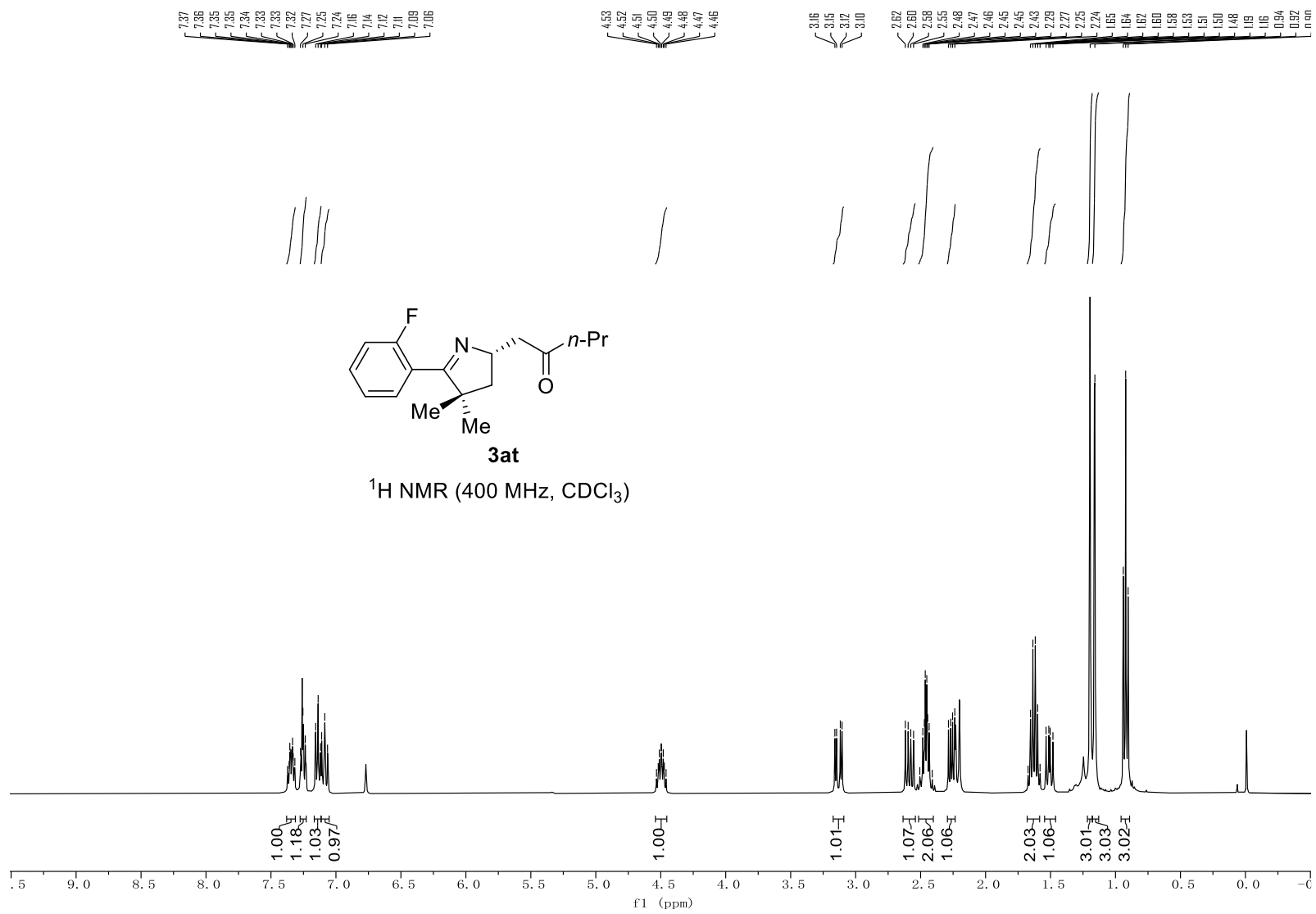


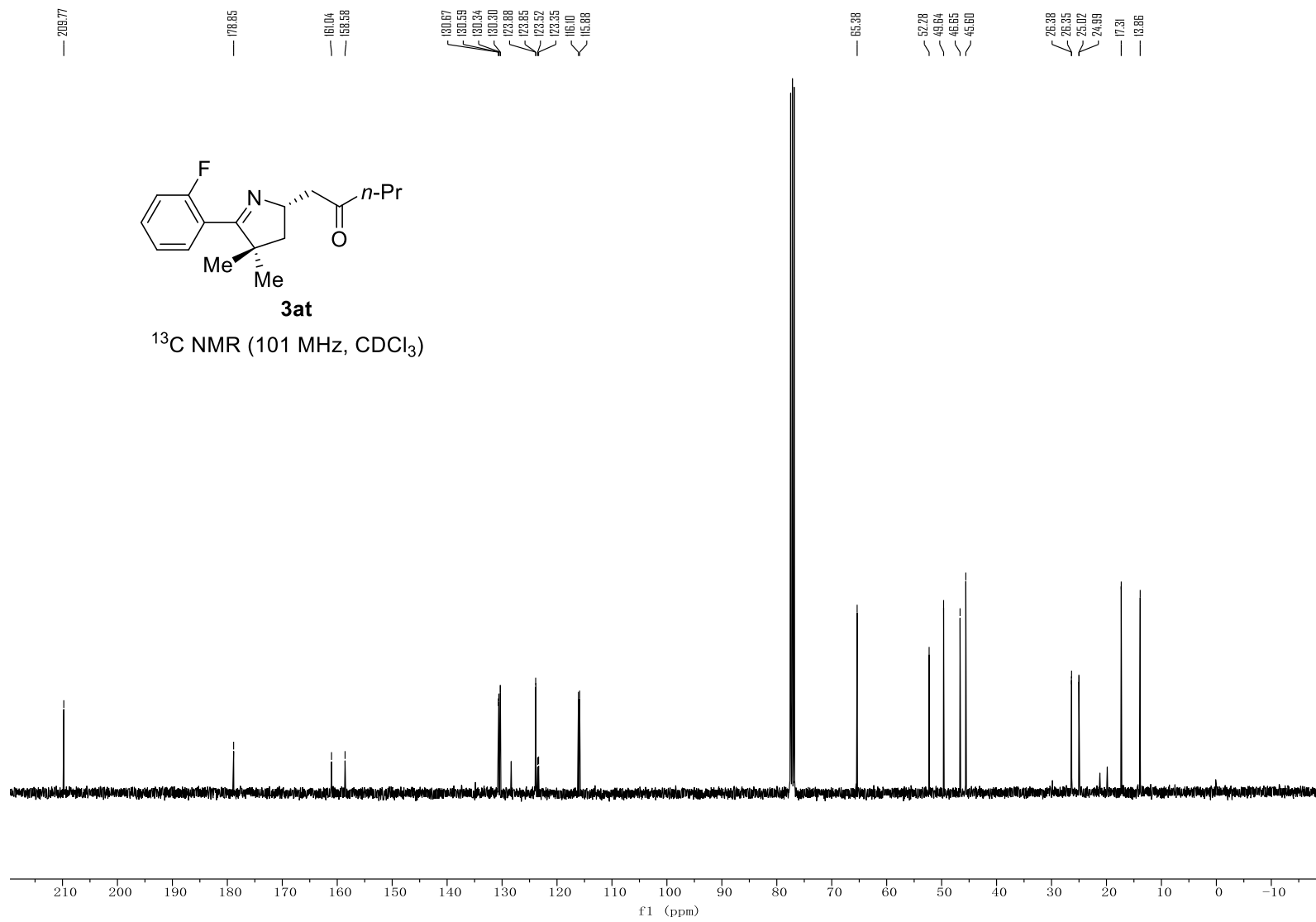


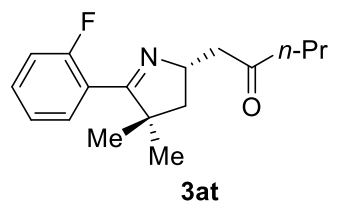


^{19}F NMR (376 MHz, CDCl_3)

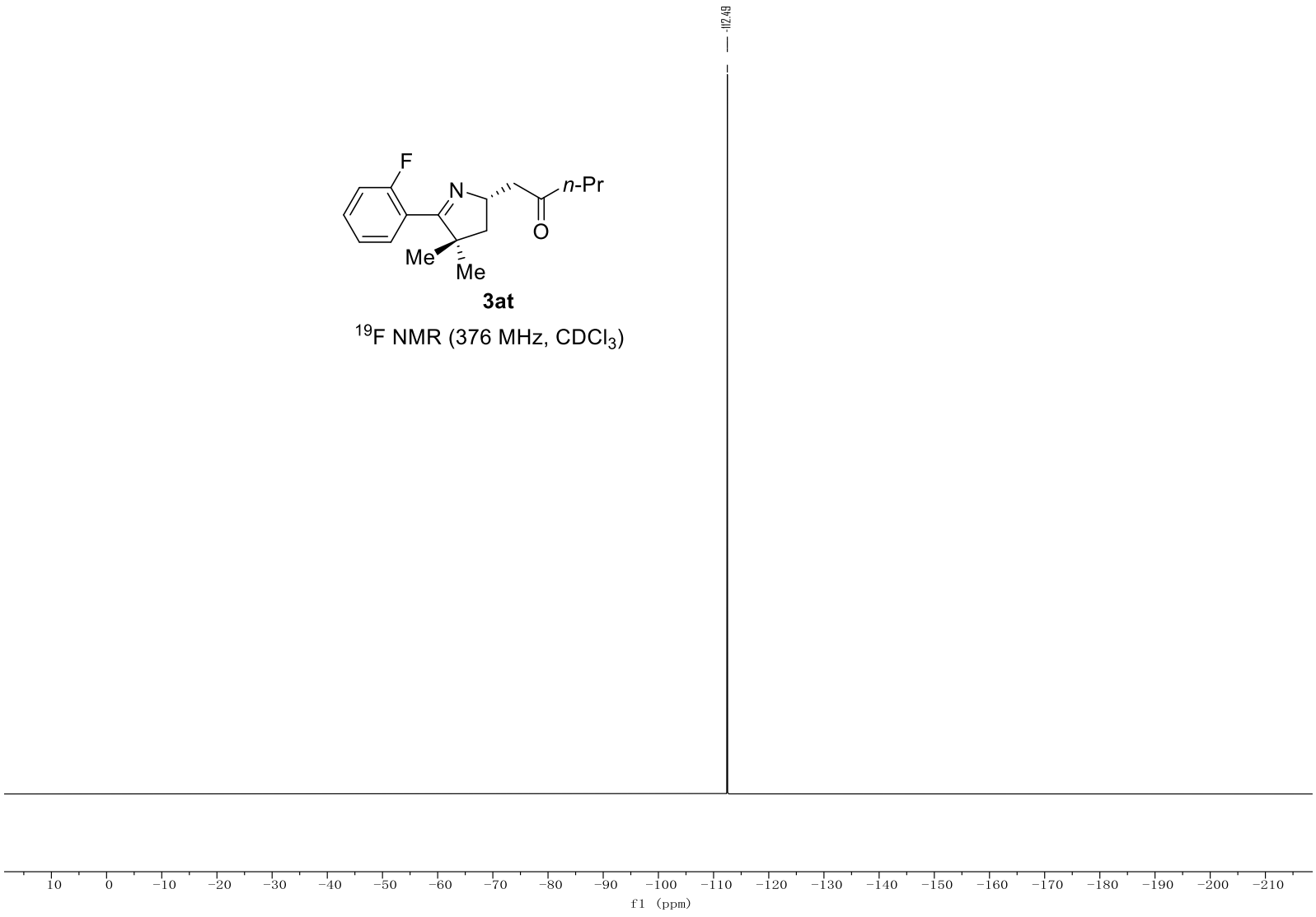


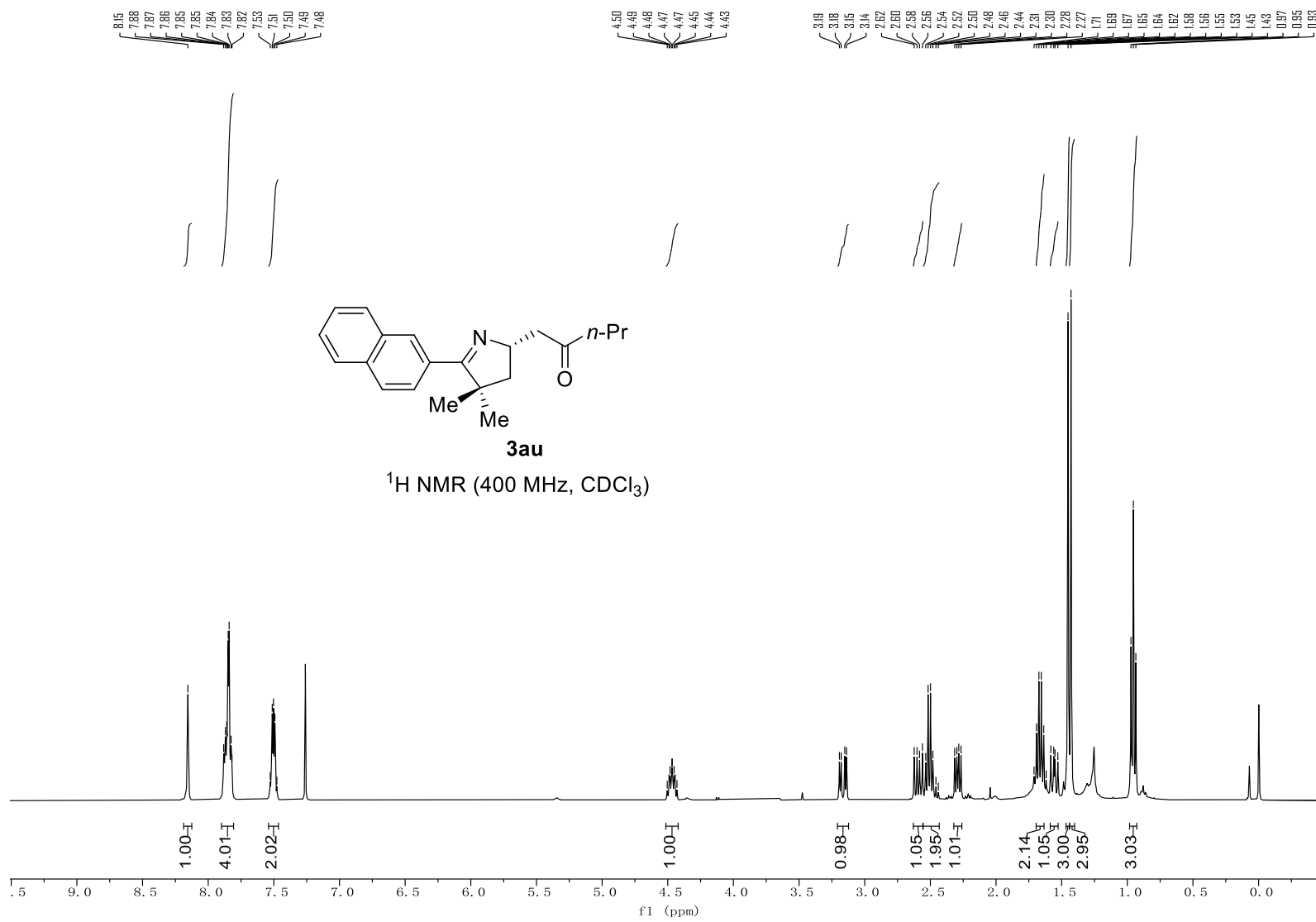


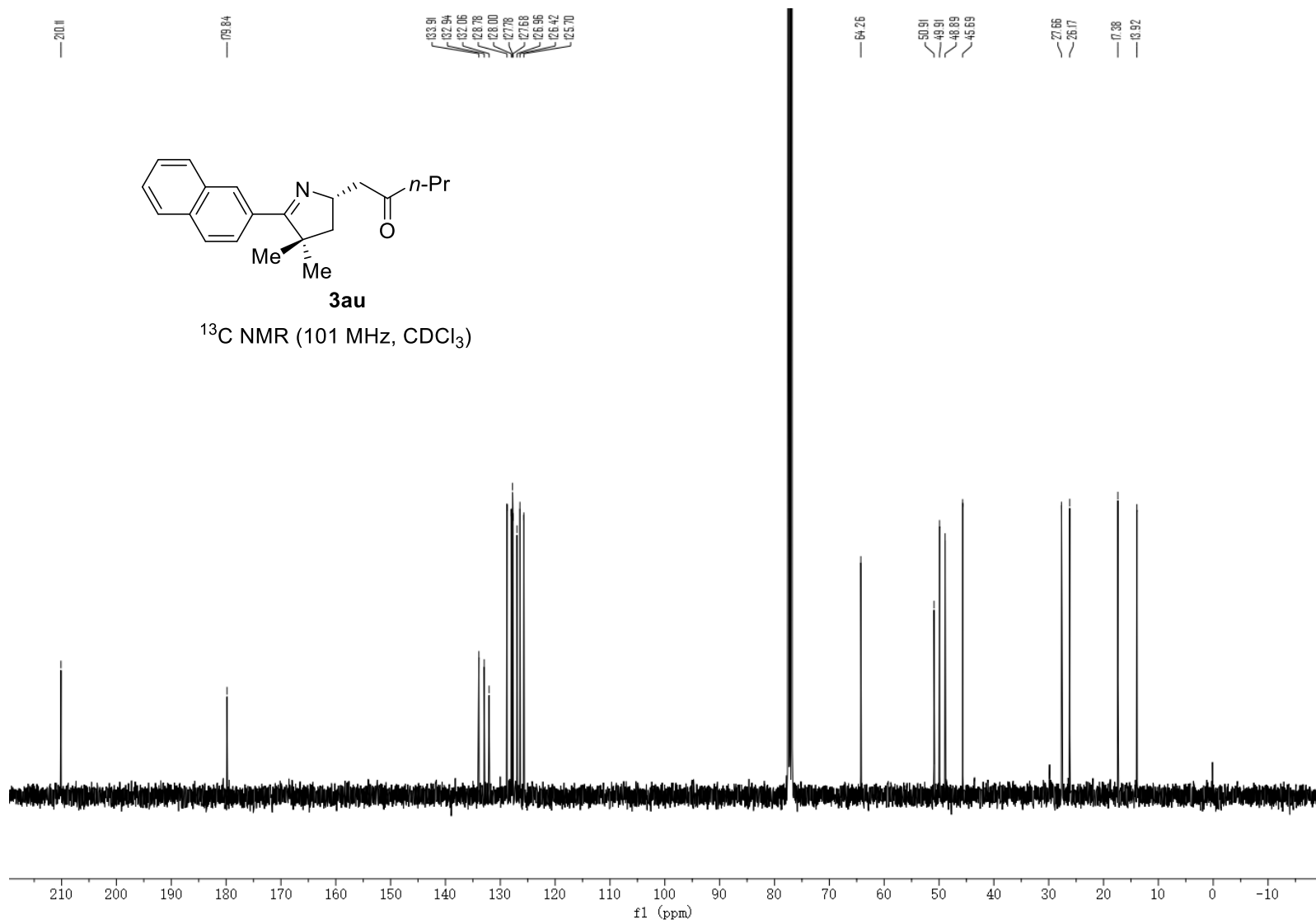


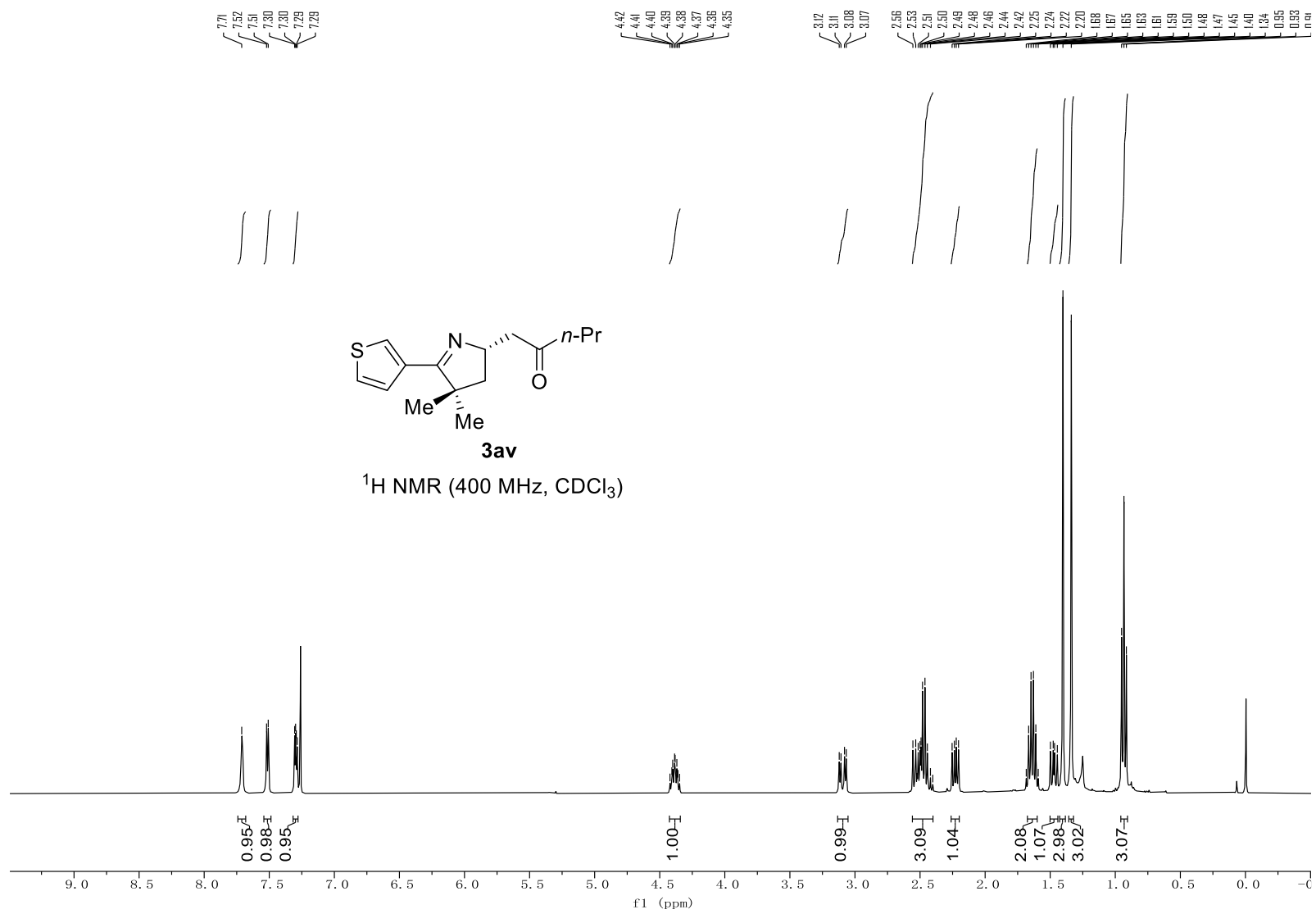


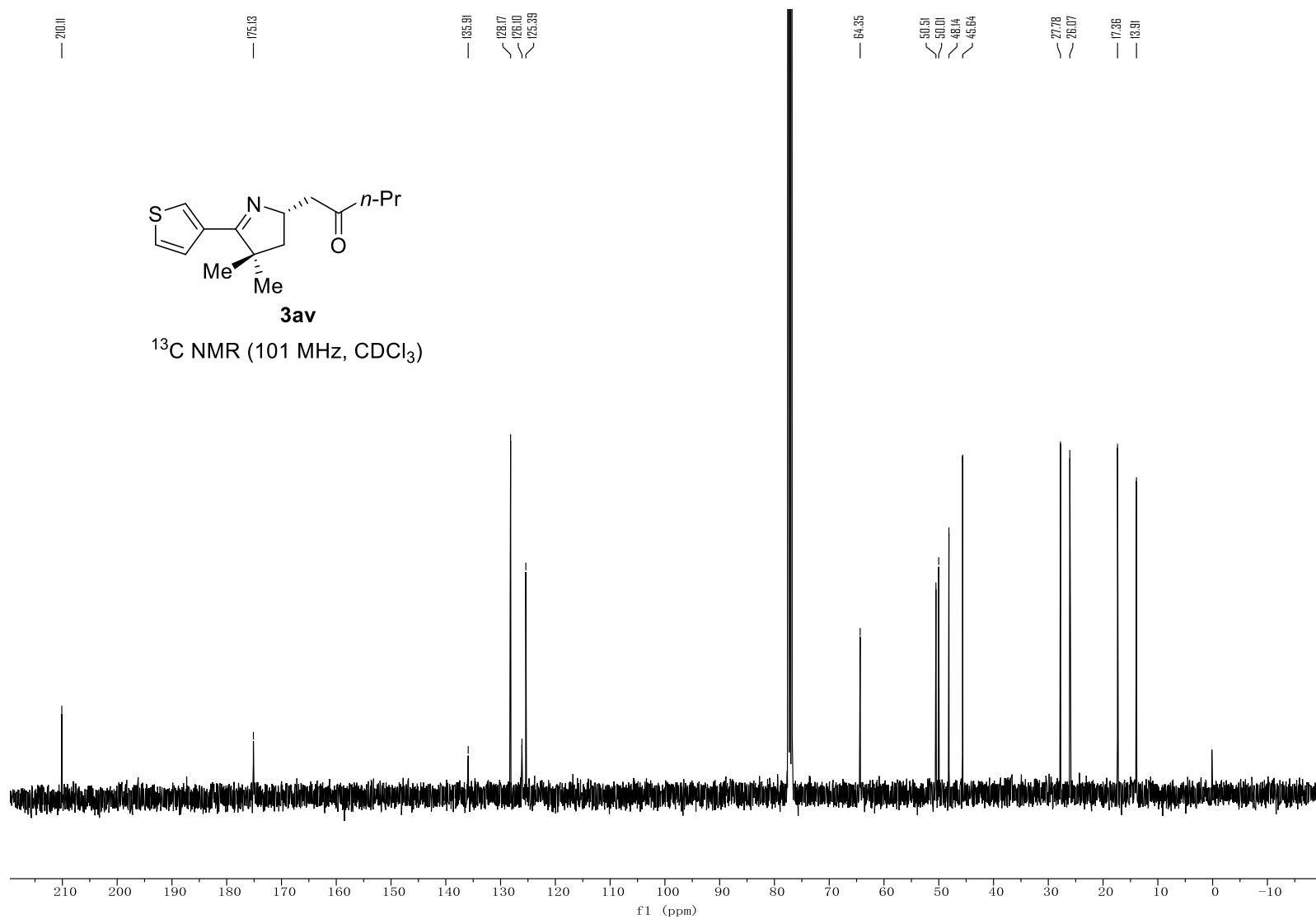
¹⁹F NMR (376 MHz, CDCl₃)

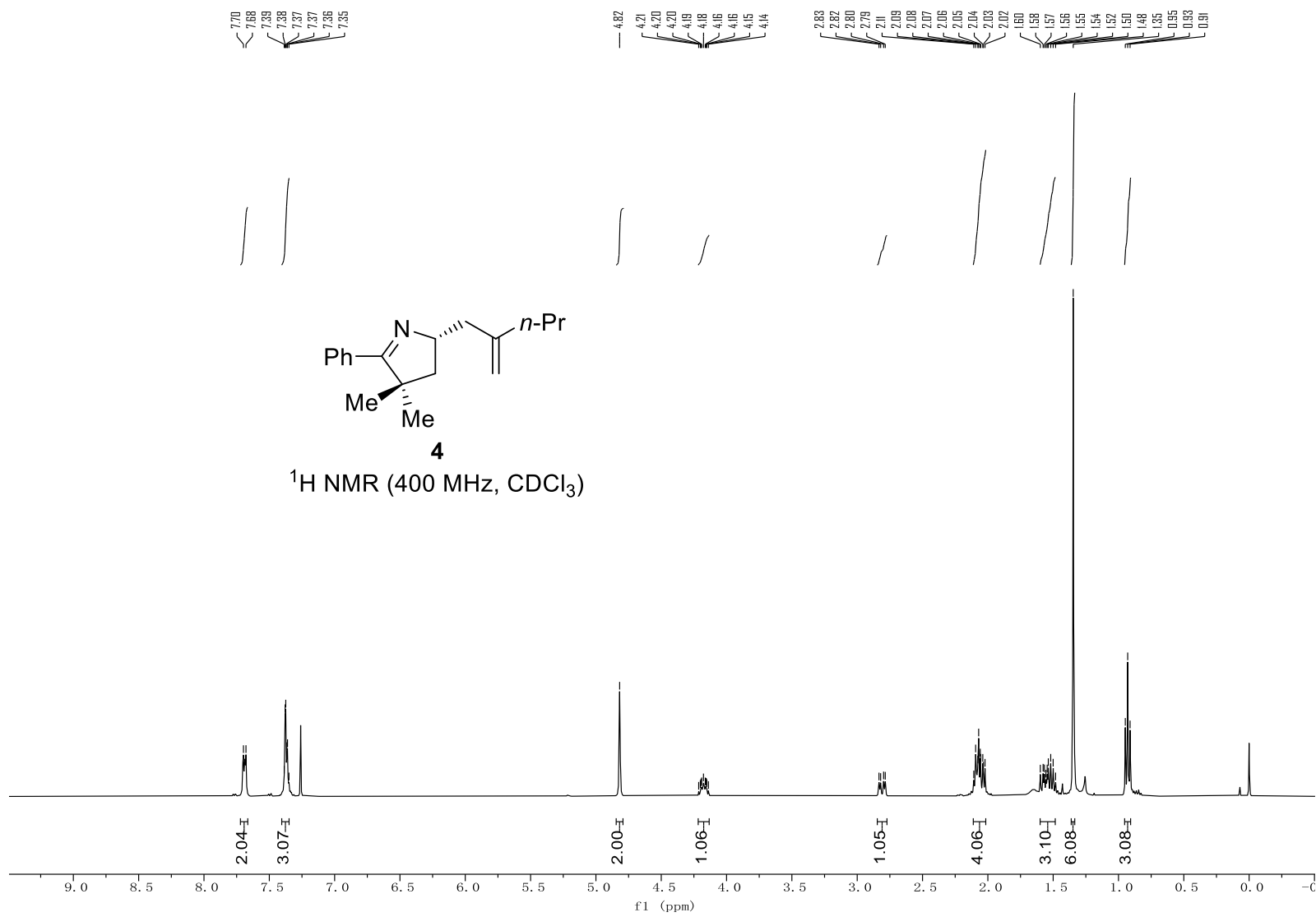


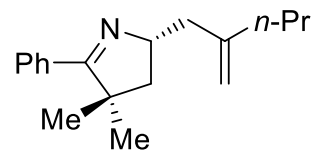






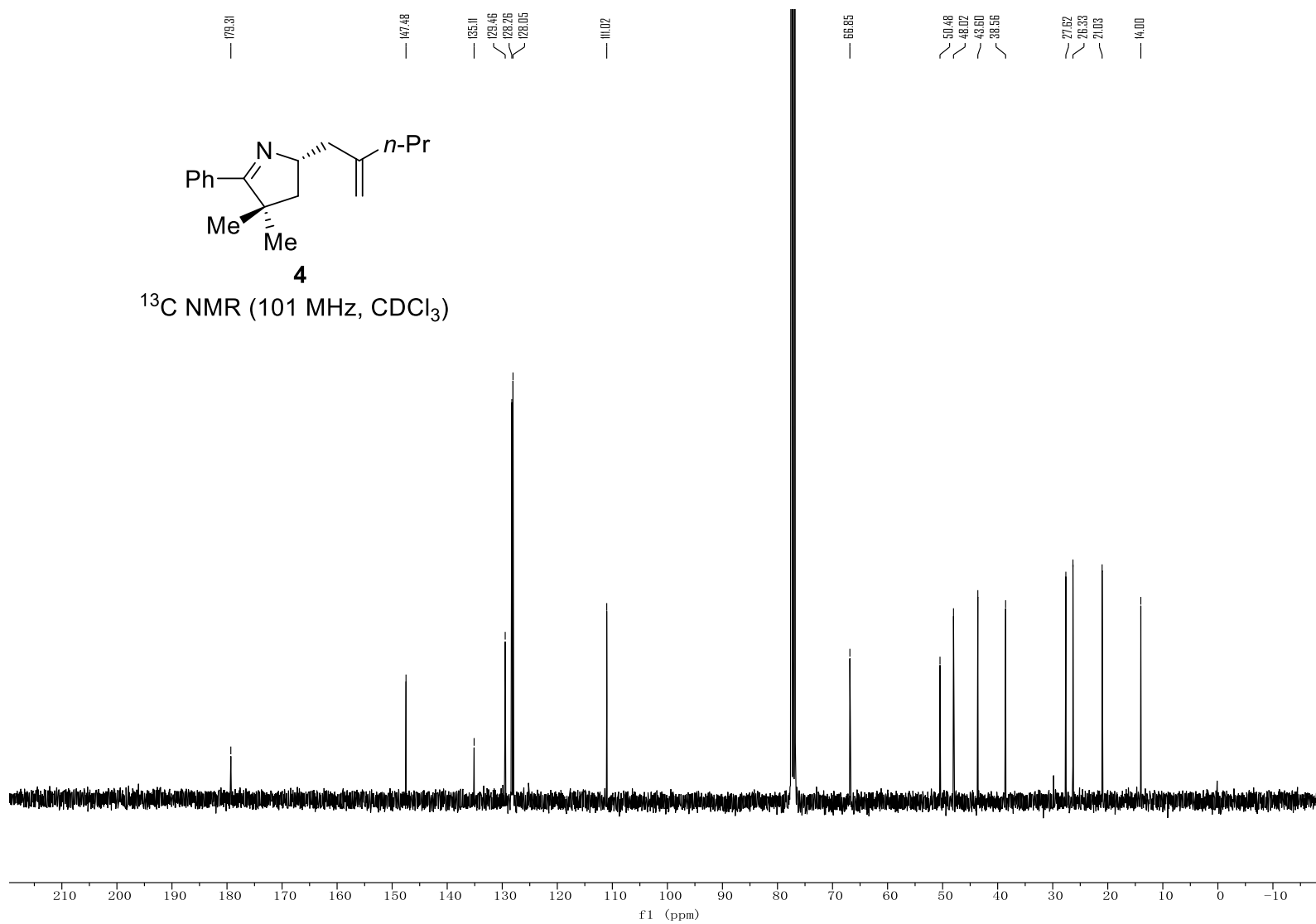


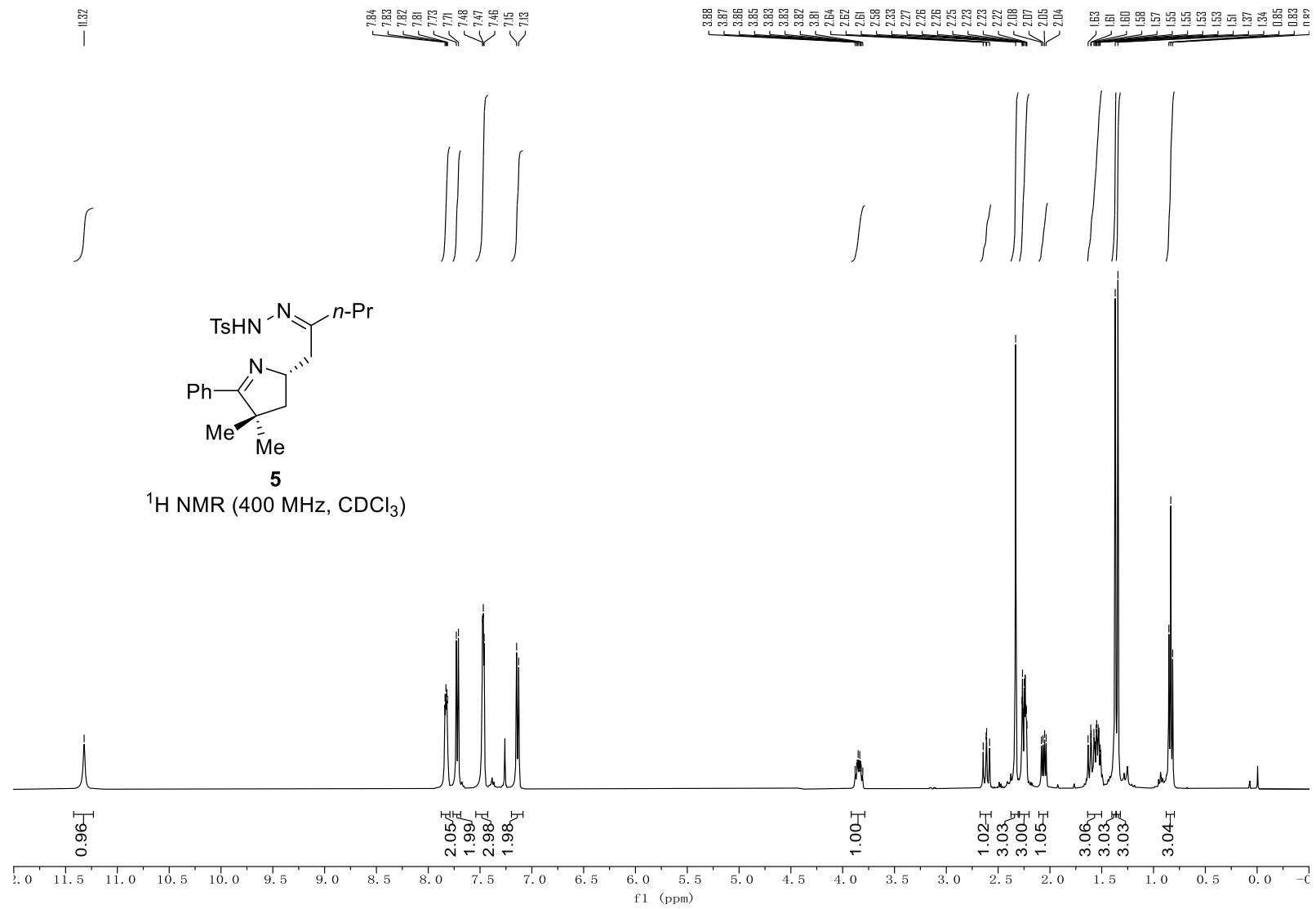


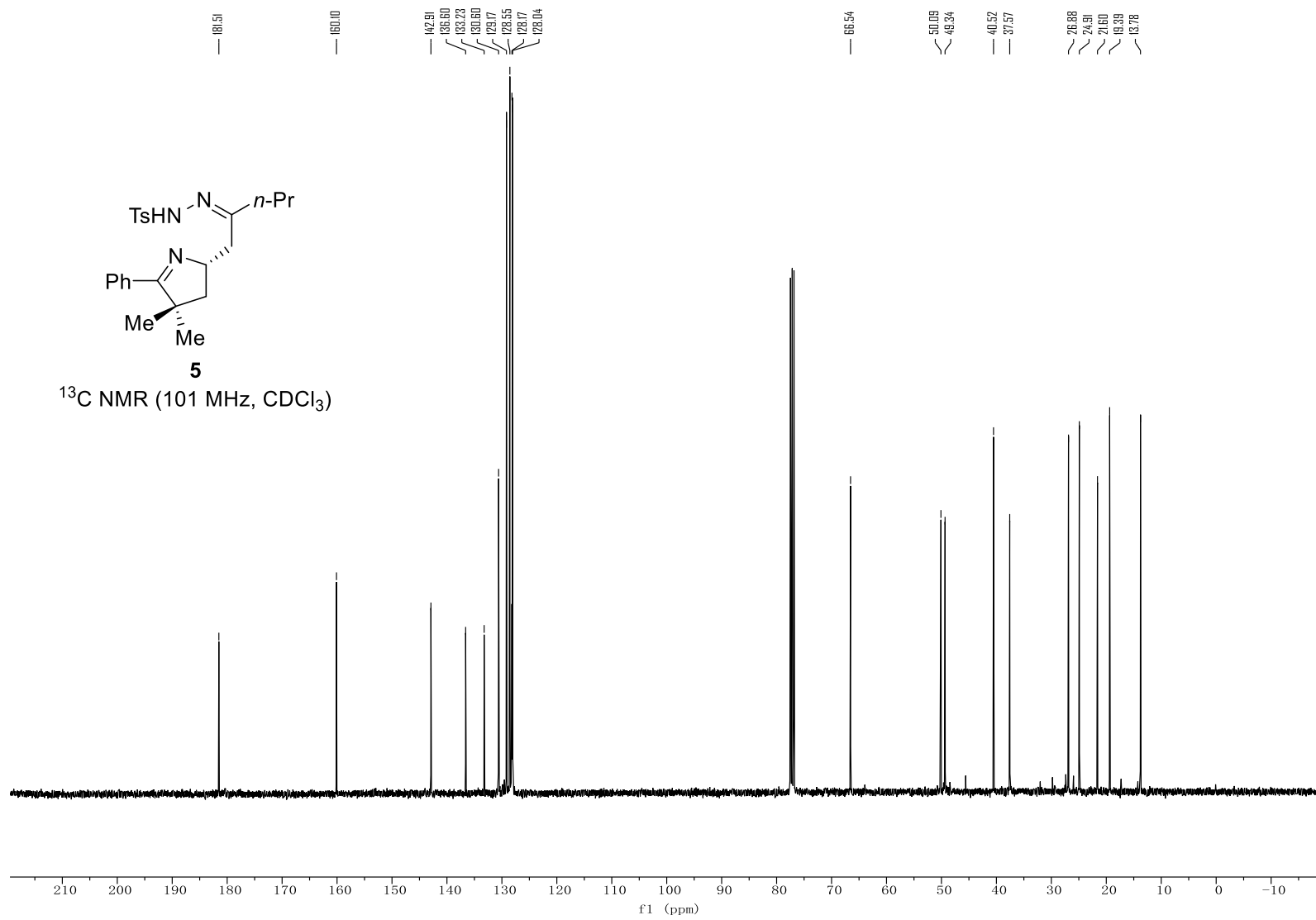


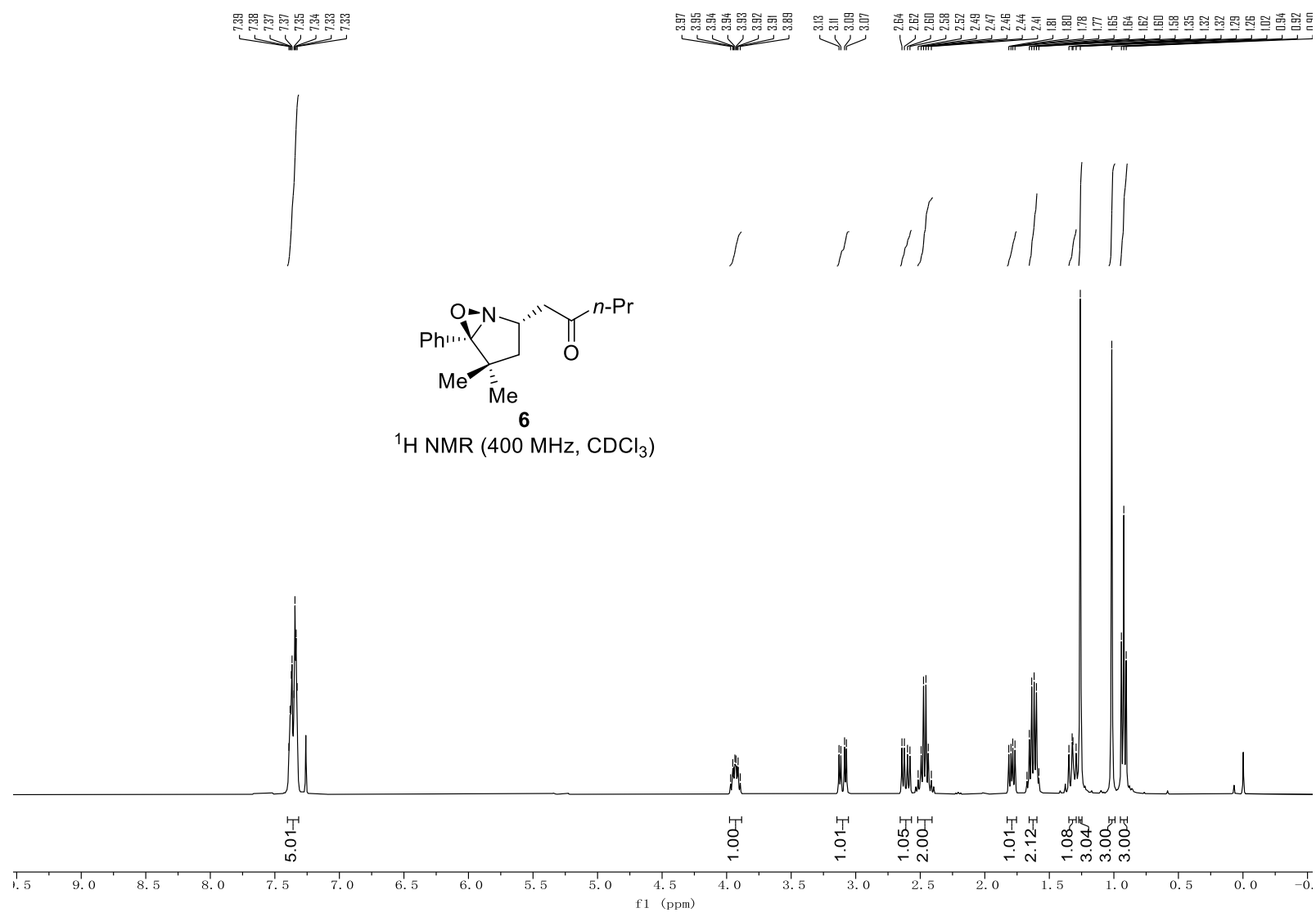
4

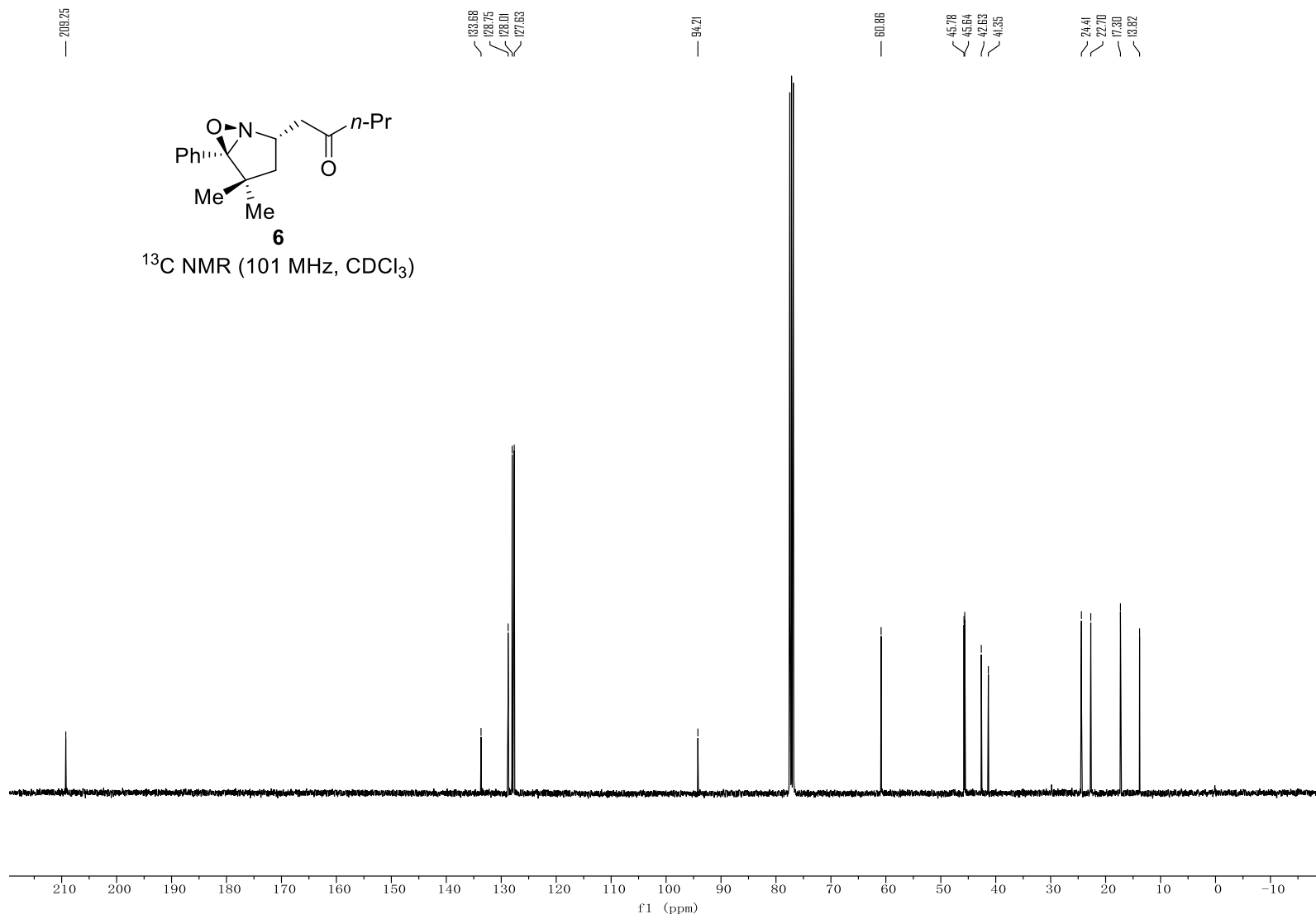
^{13}C NMR (101 MHz, CDCl_3)



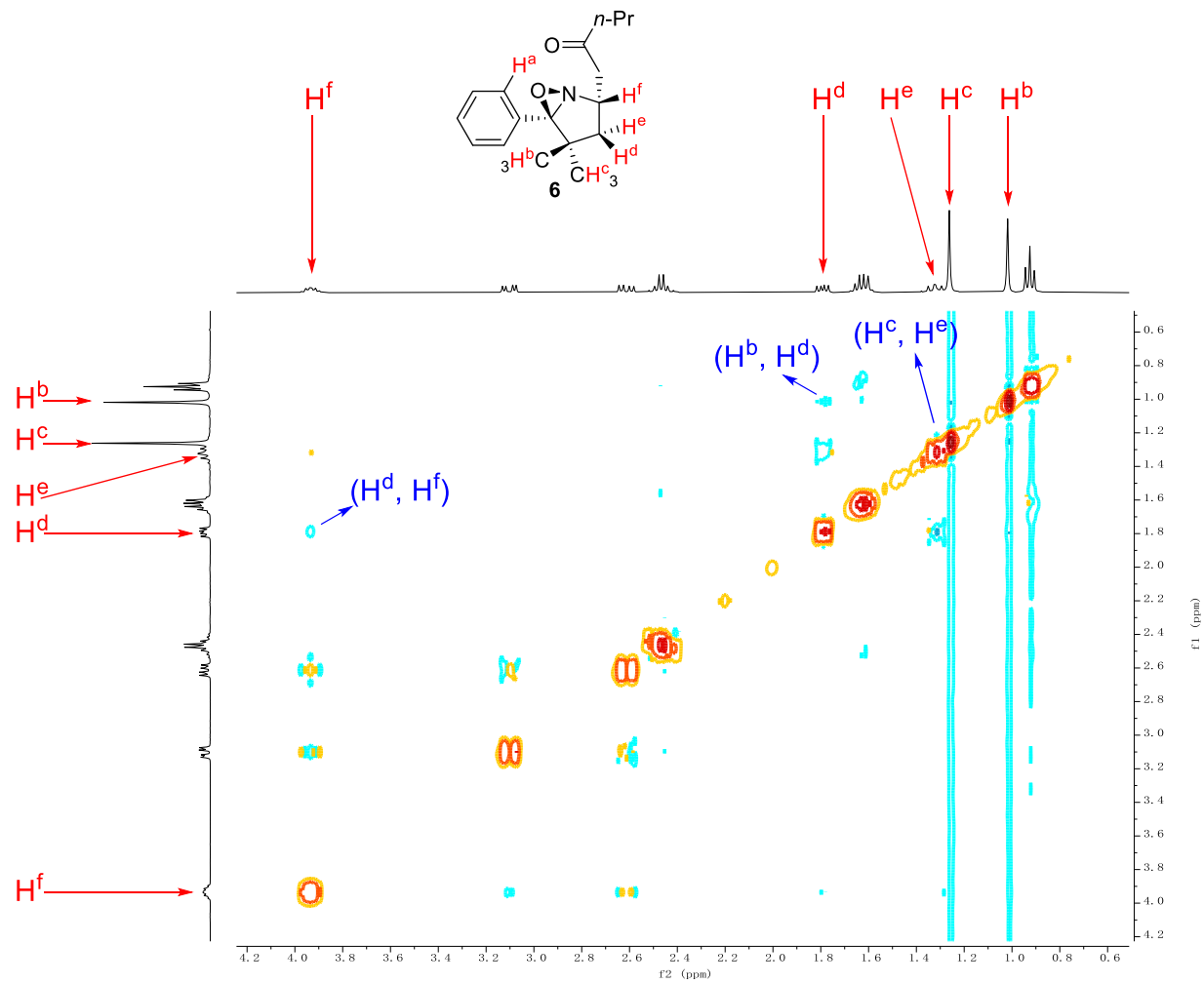


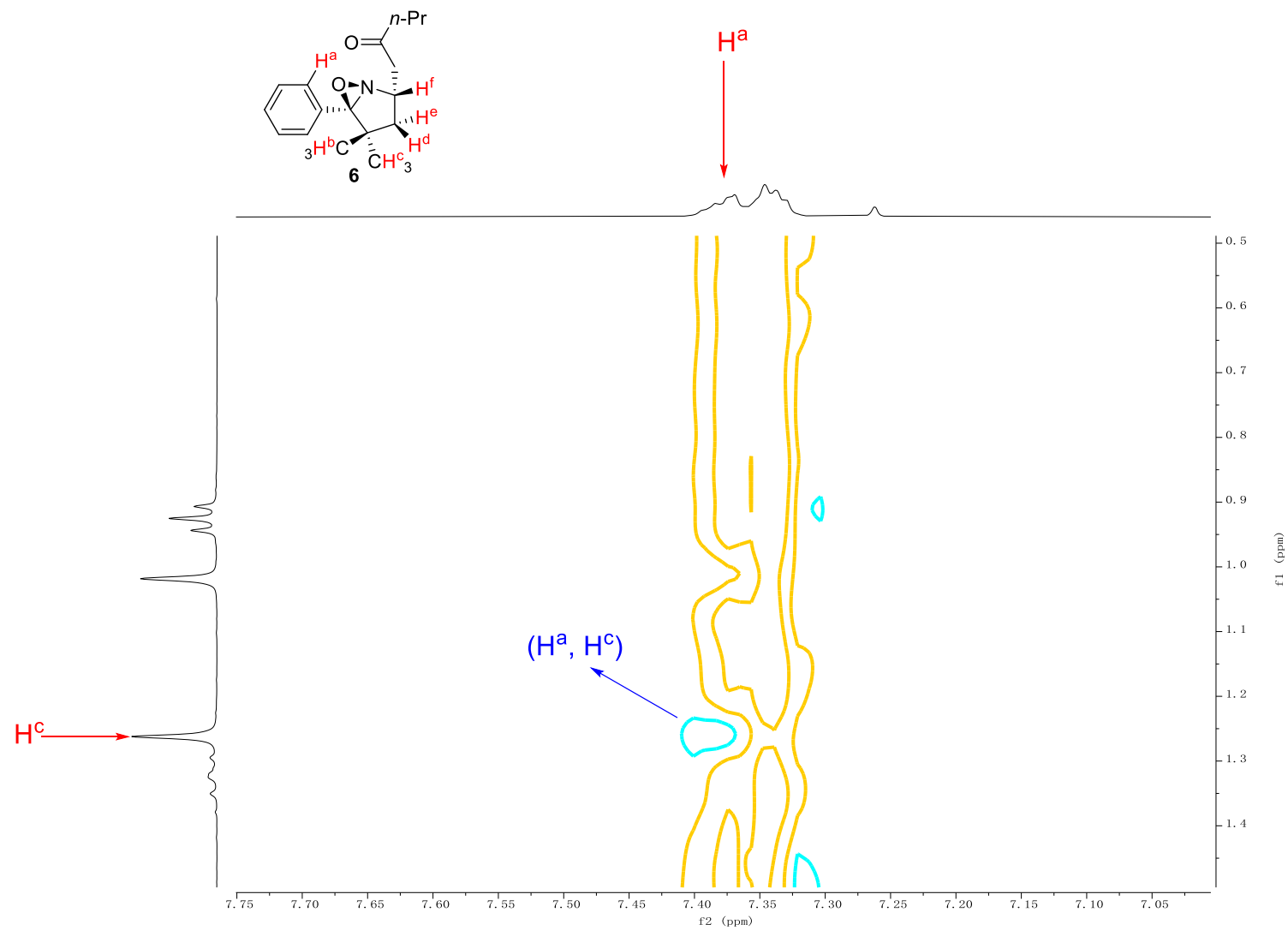


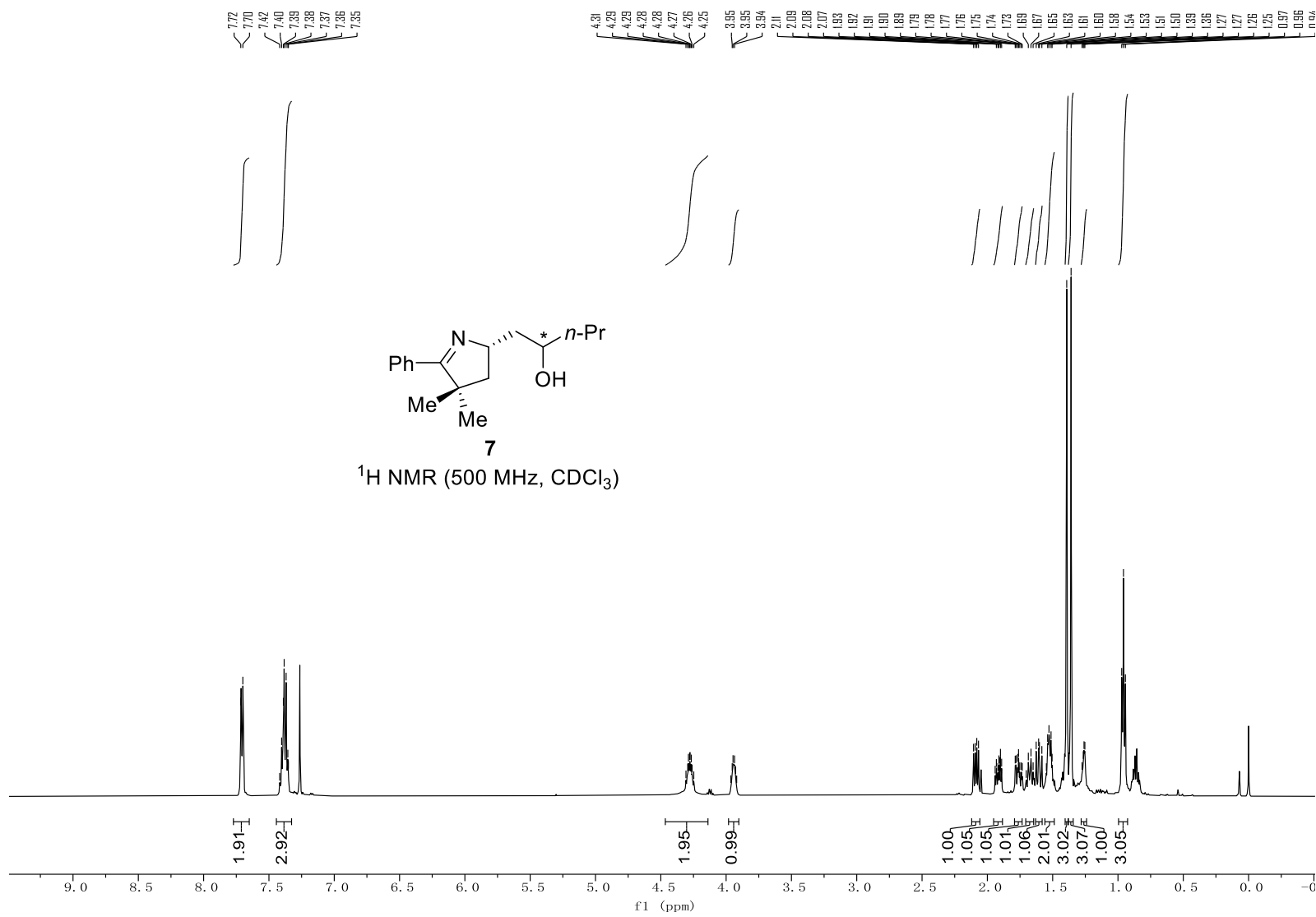


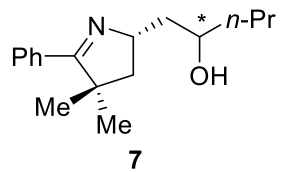


NOESY

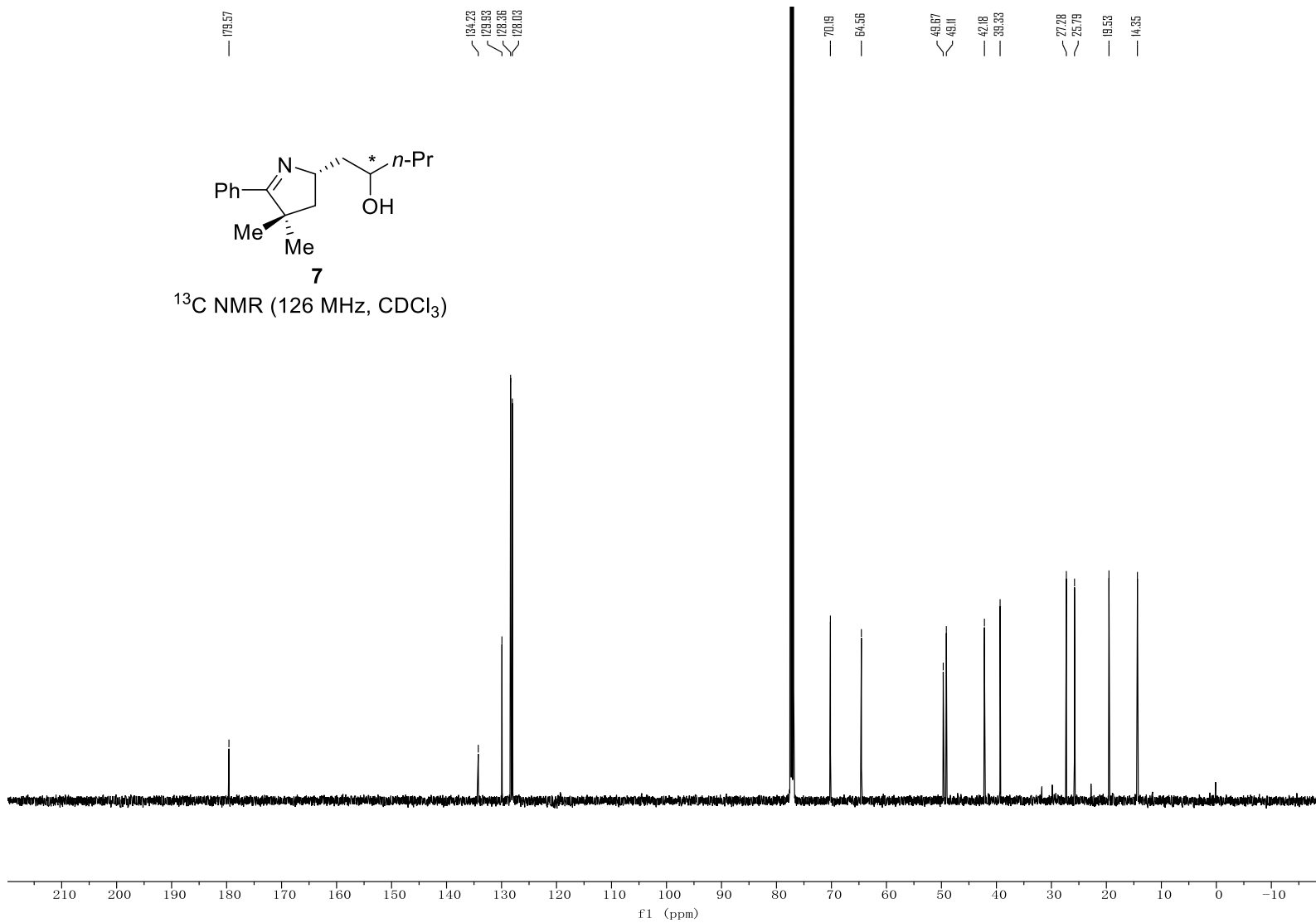


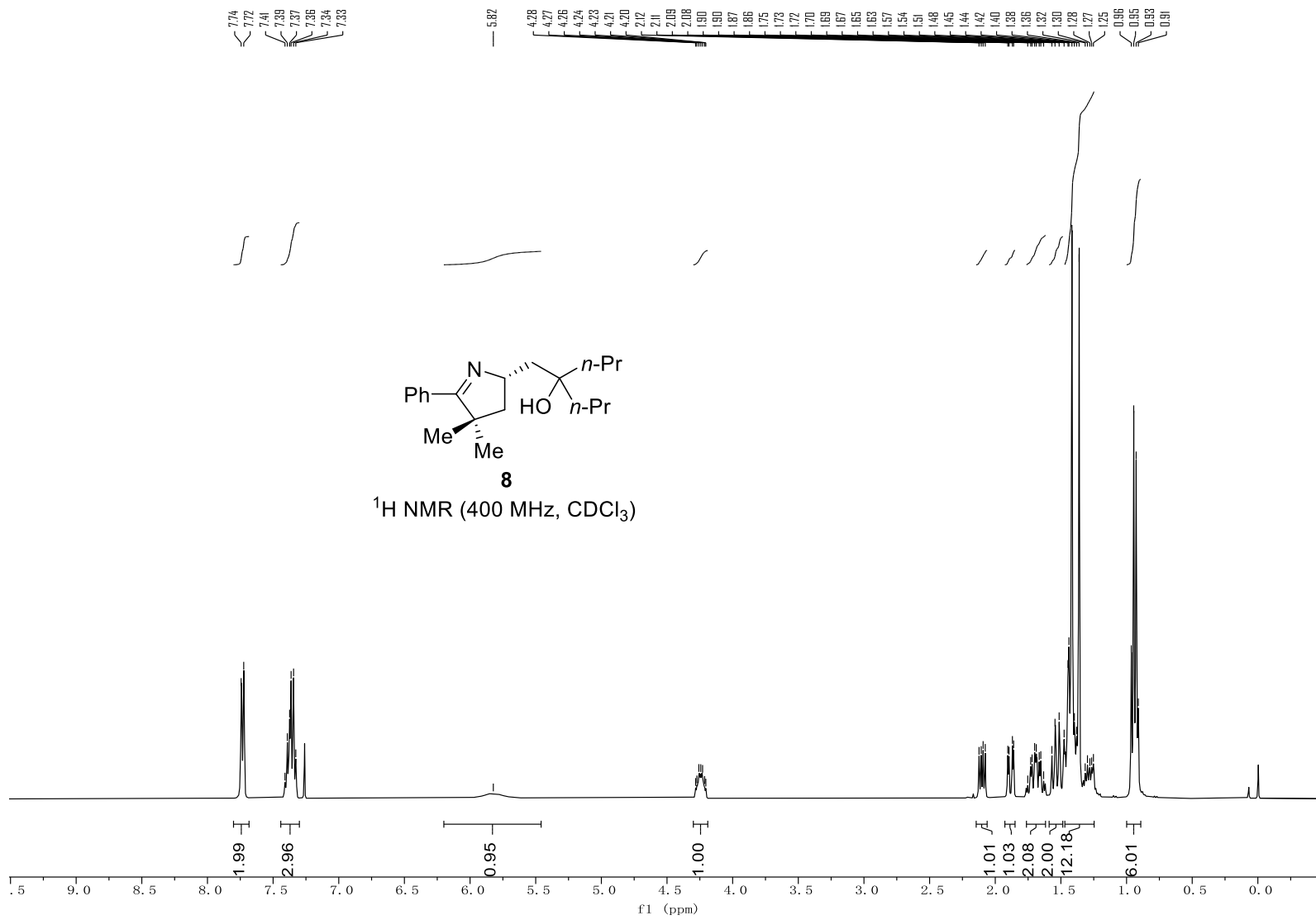


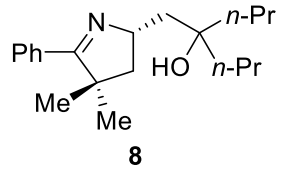




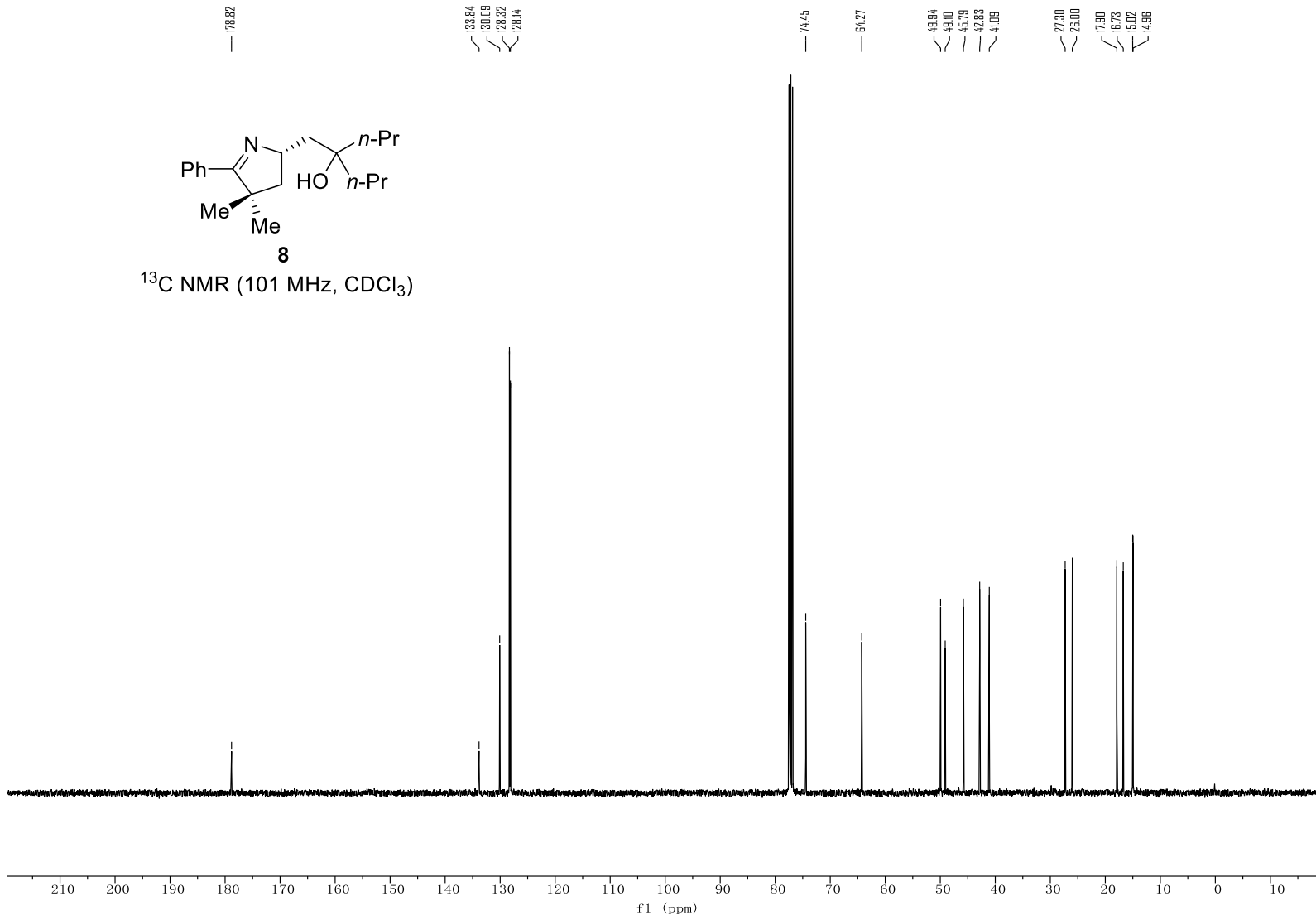
¹³C NMR (126 MHz, CDCl₃)

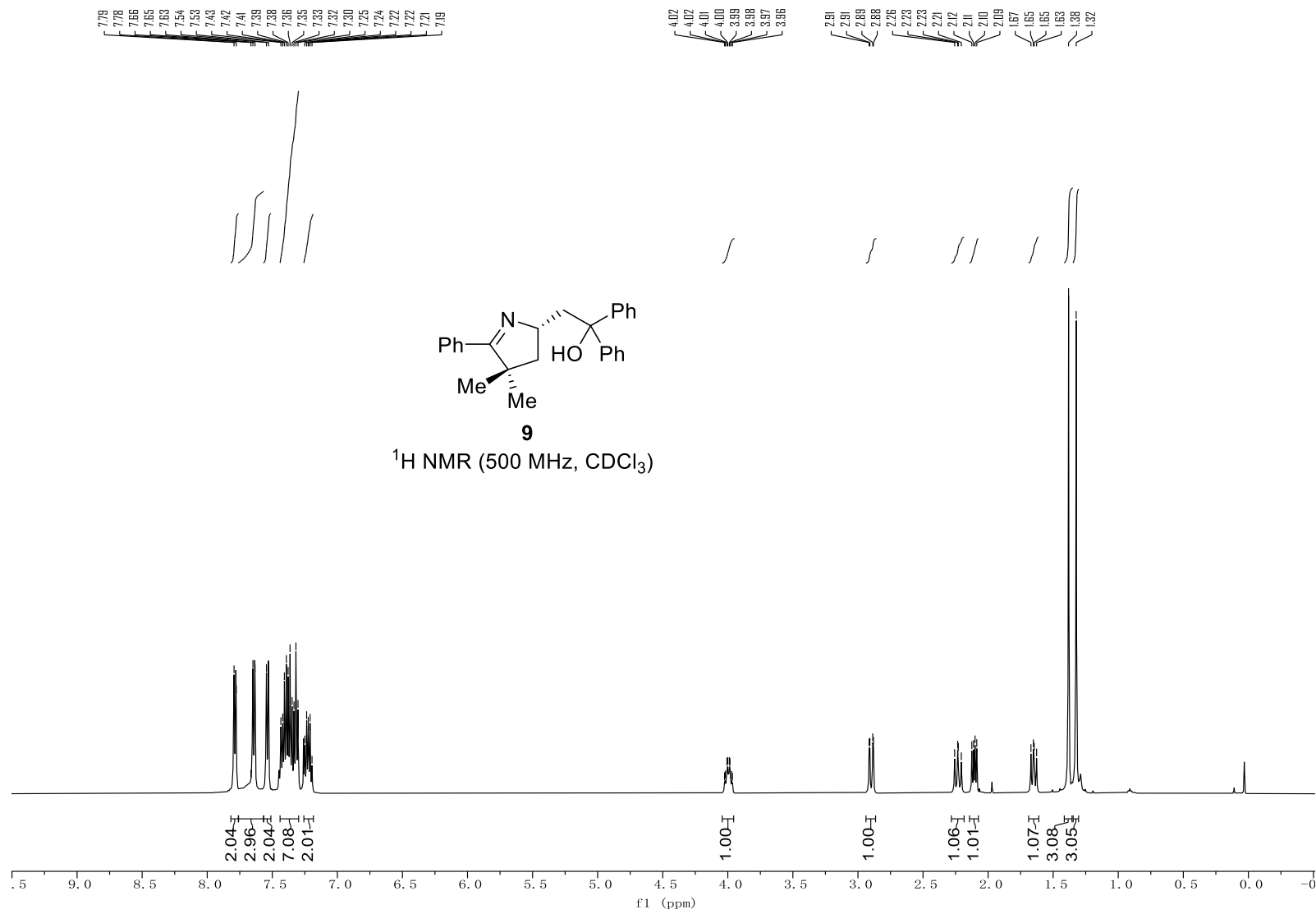


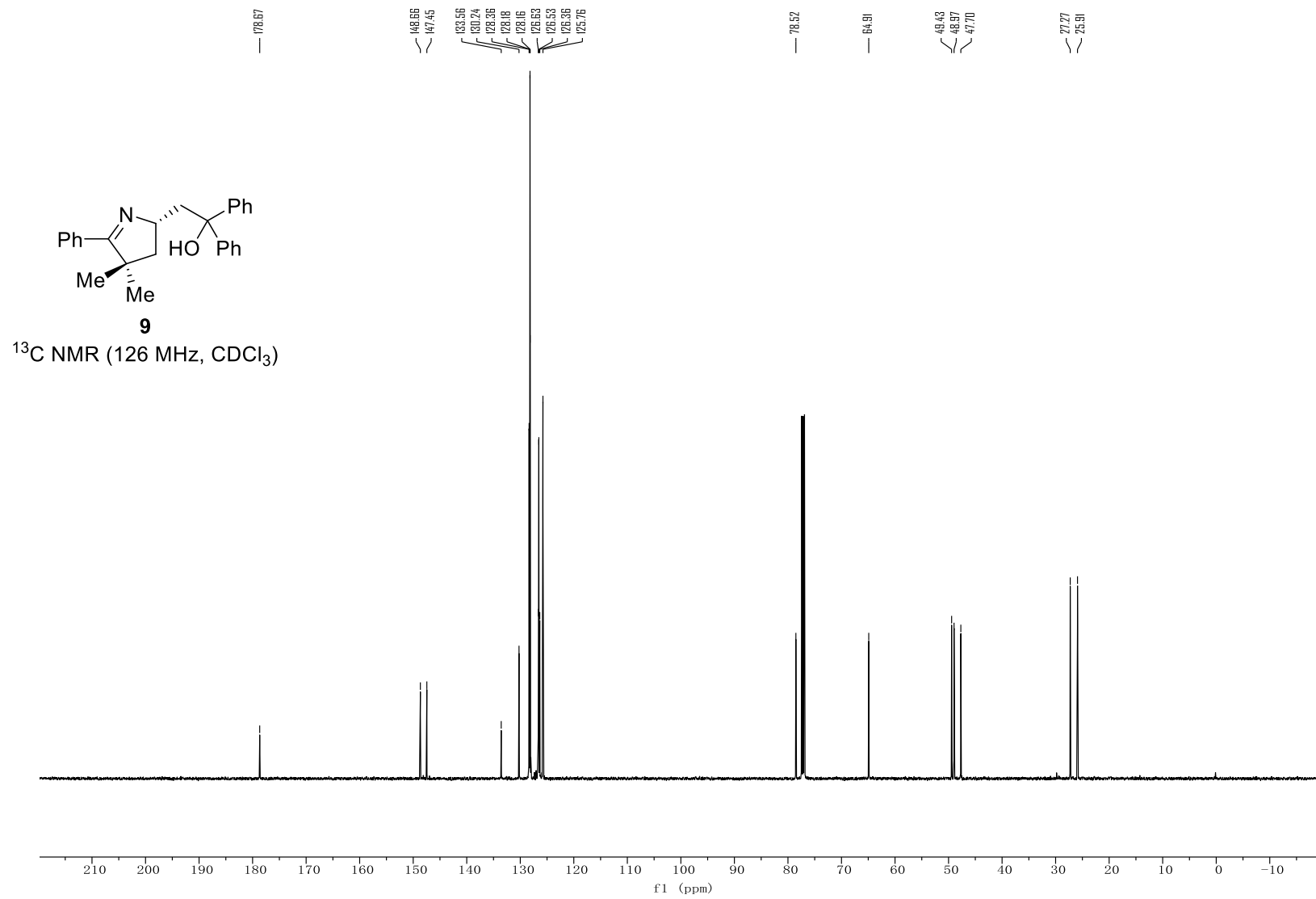


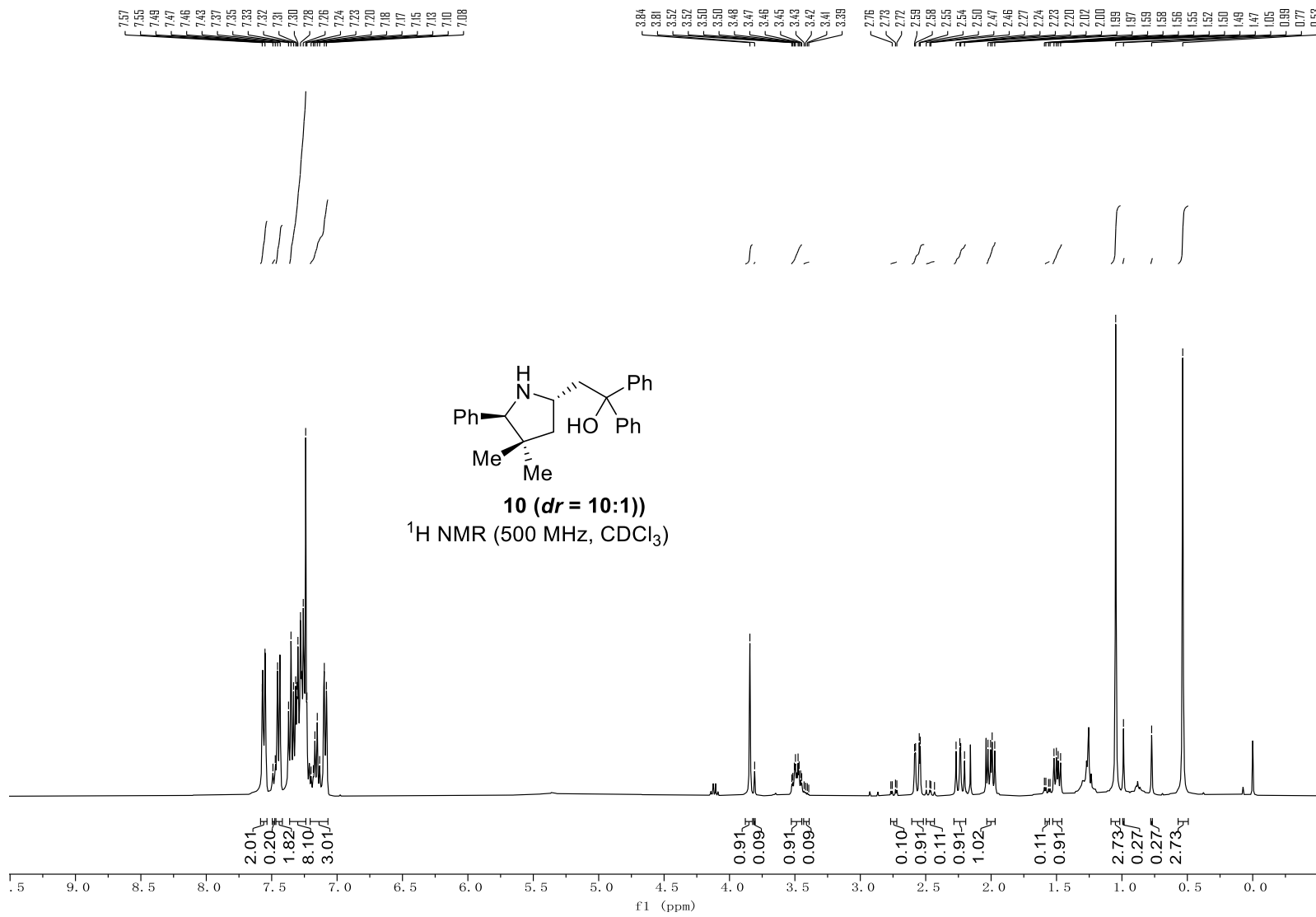


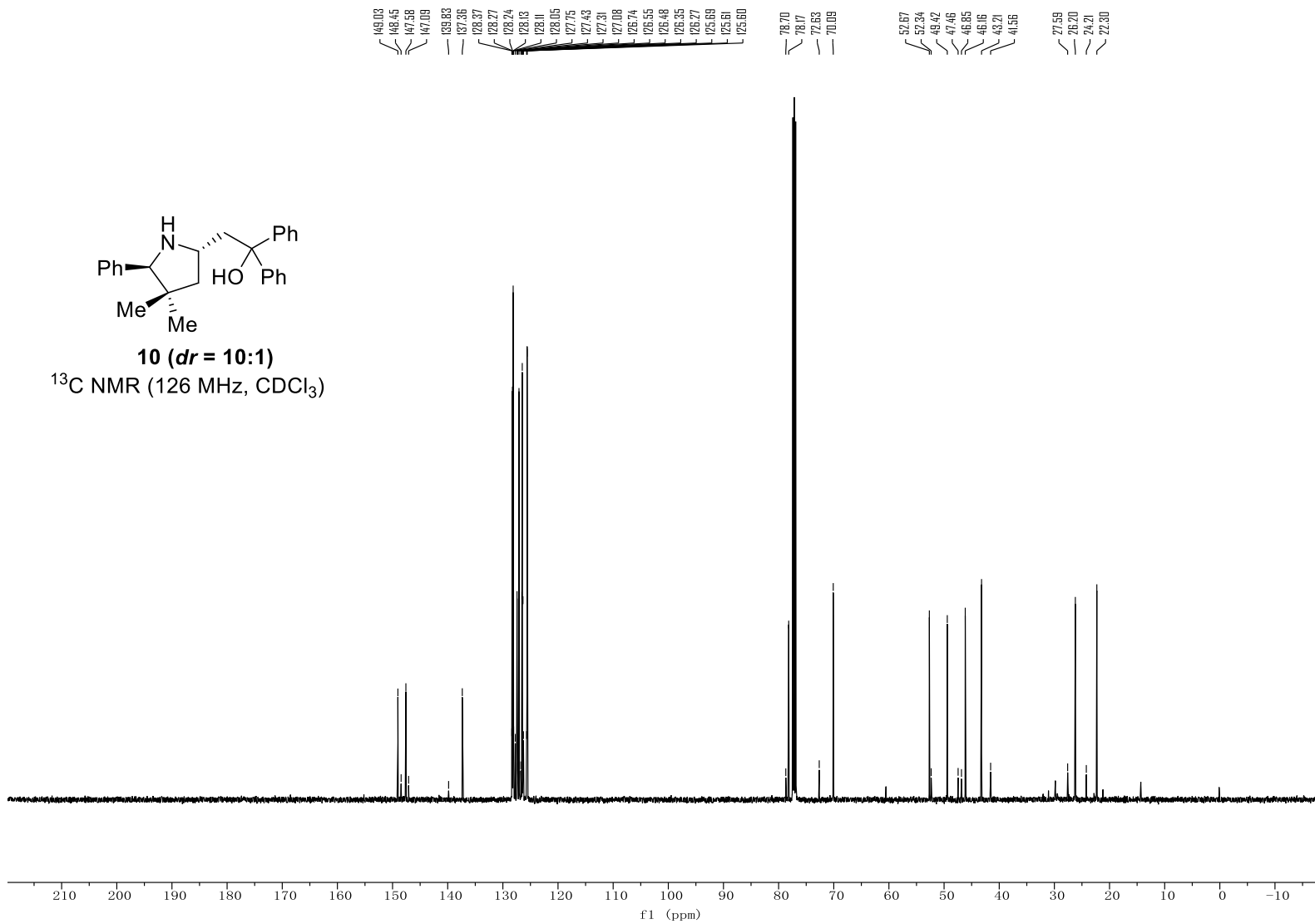
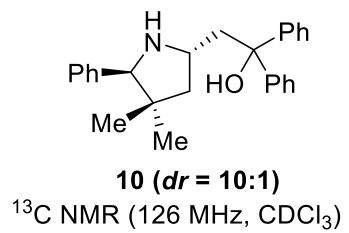
^{13}C NMR (101 MHz, CDCl_3)



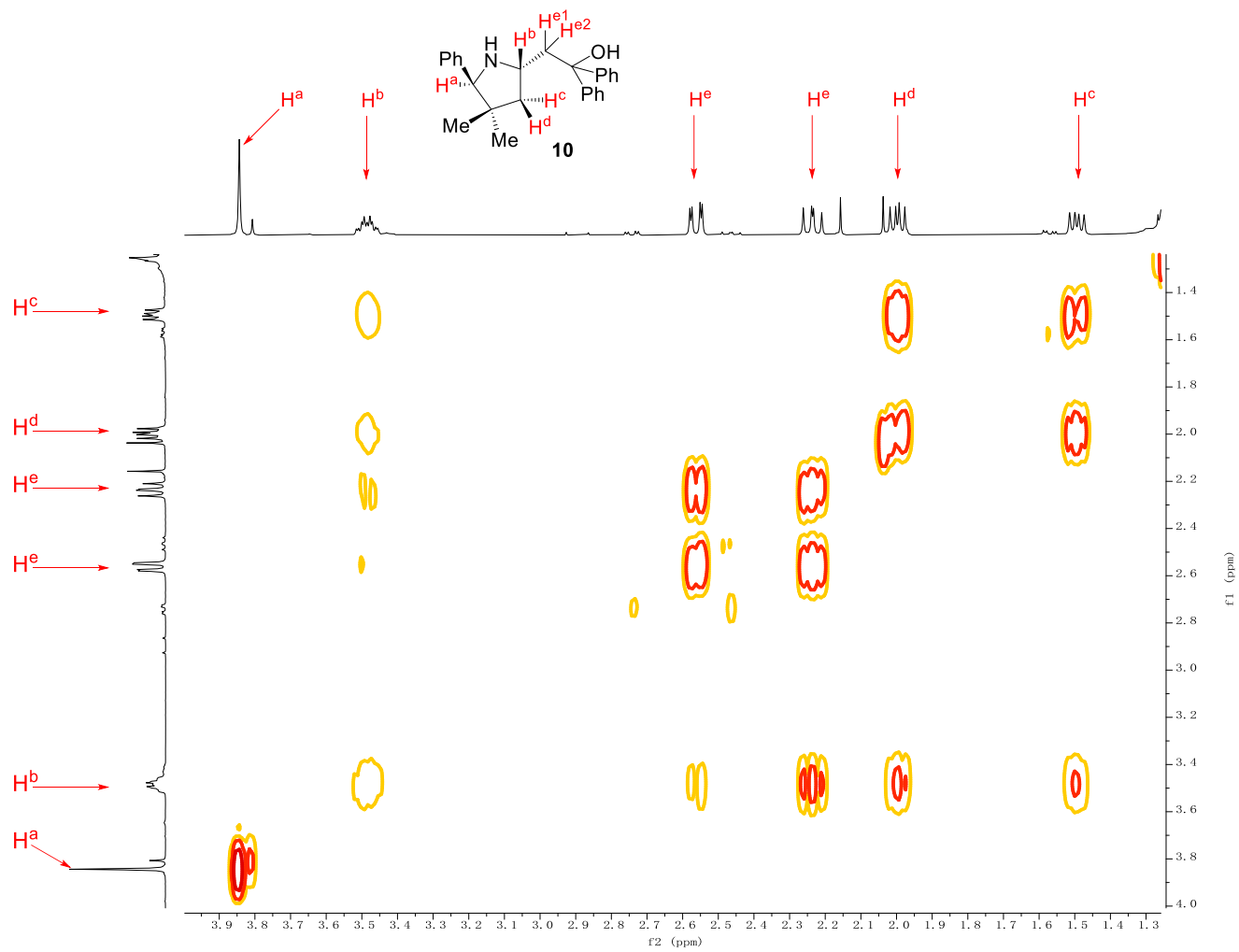




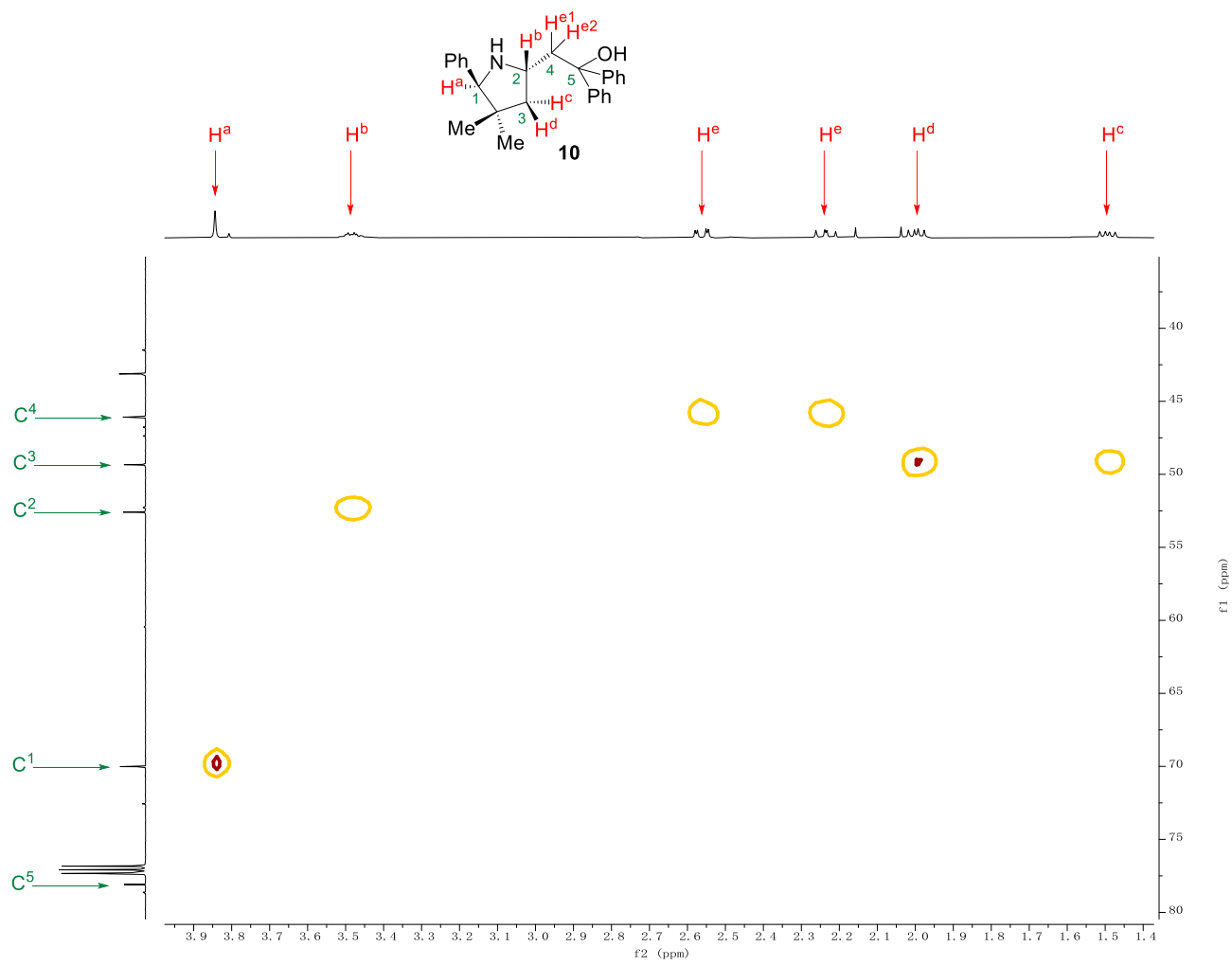




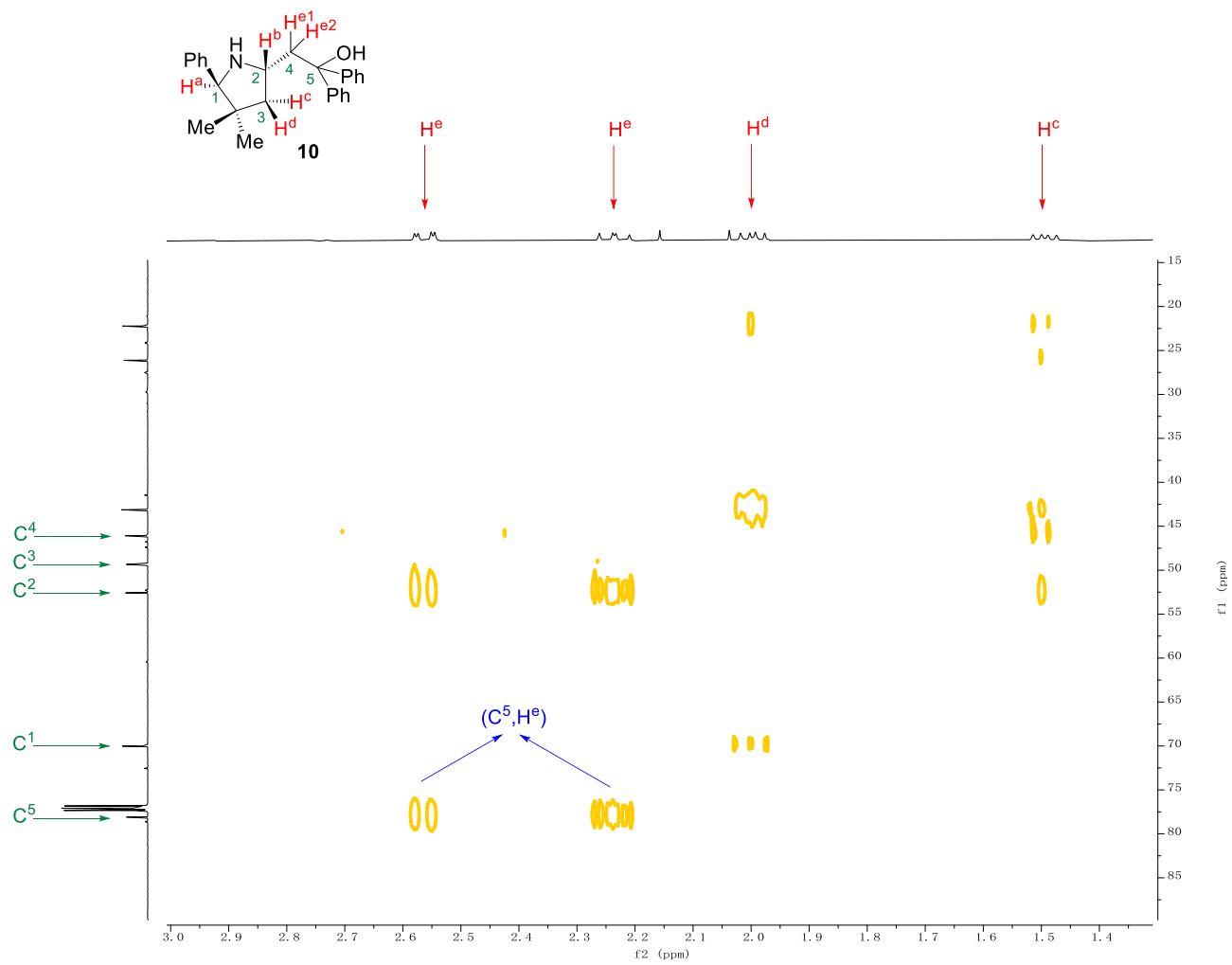
COSY



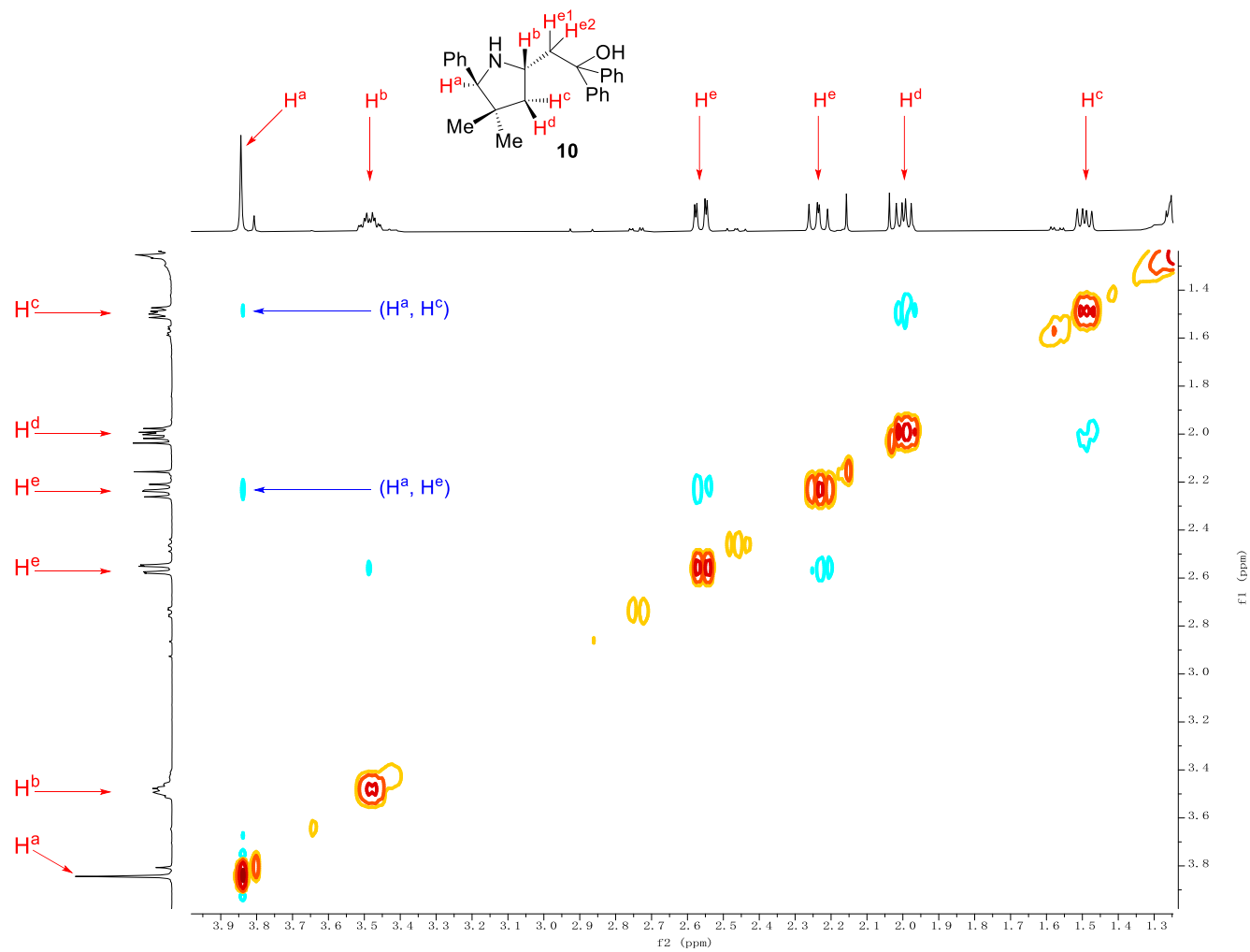
HSQC

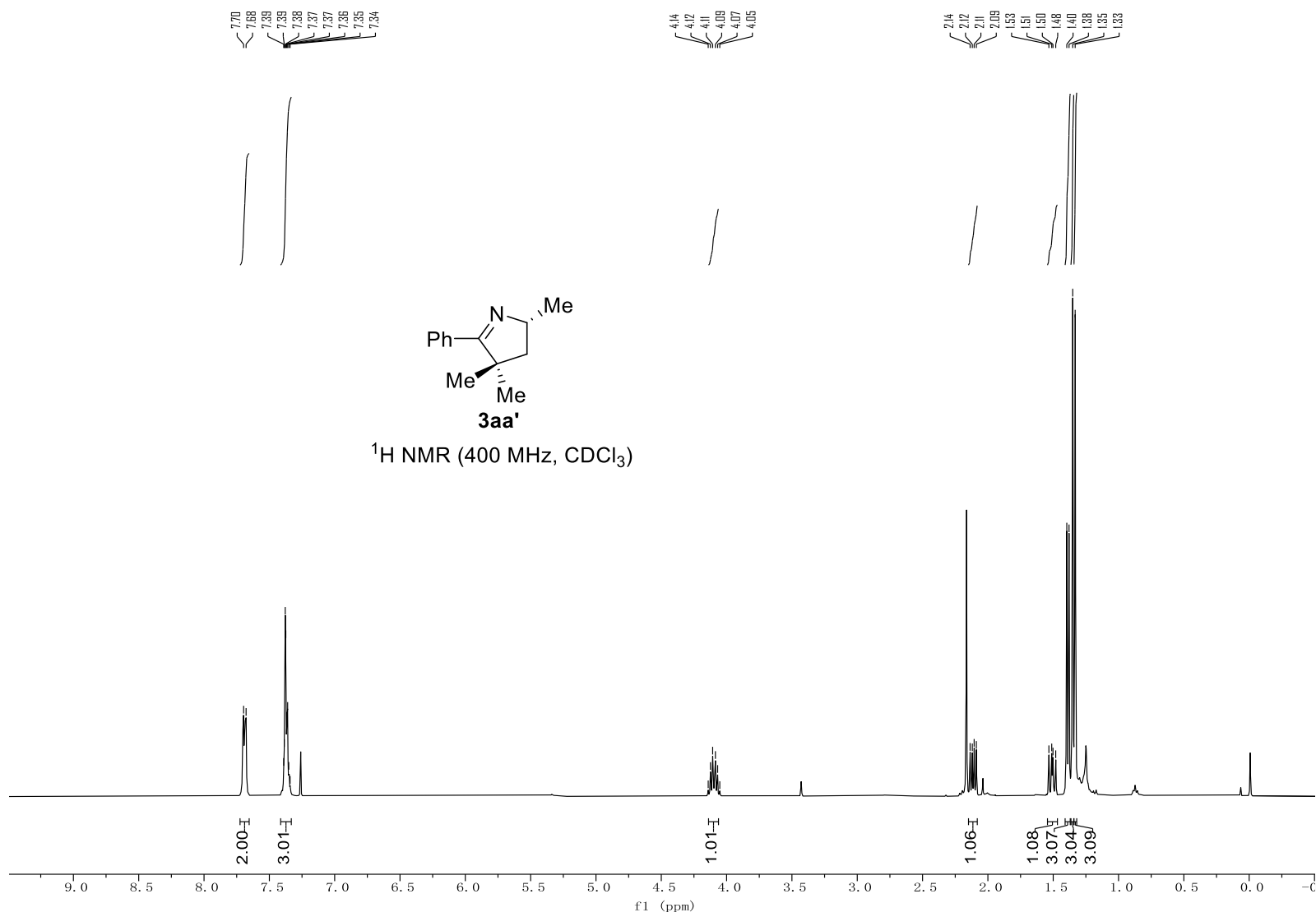


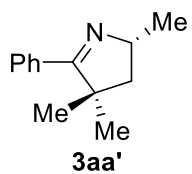
HMBC



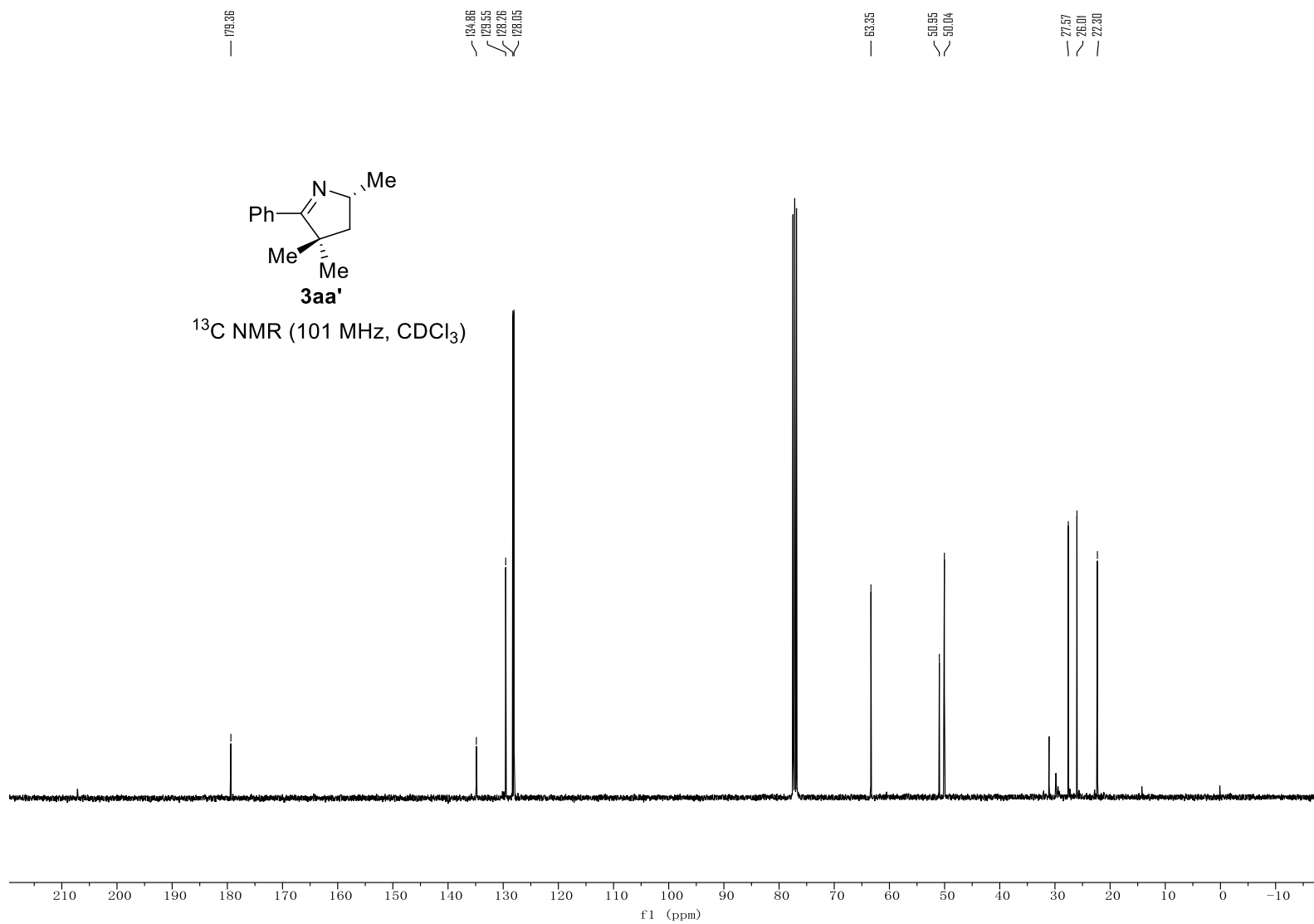
NOESY

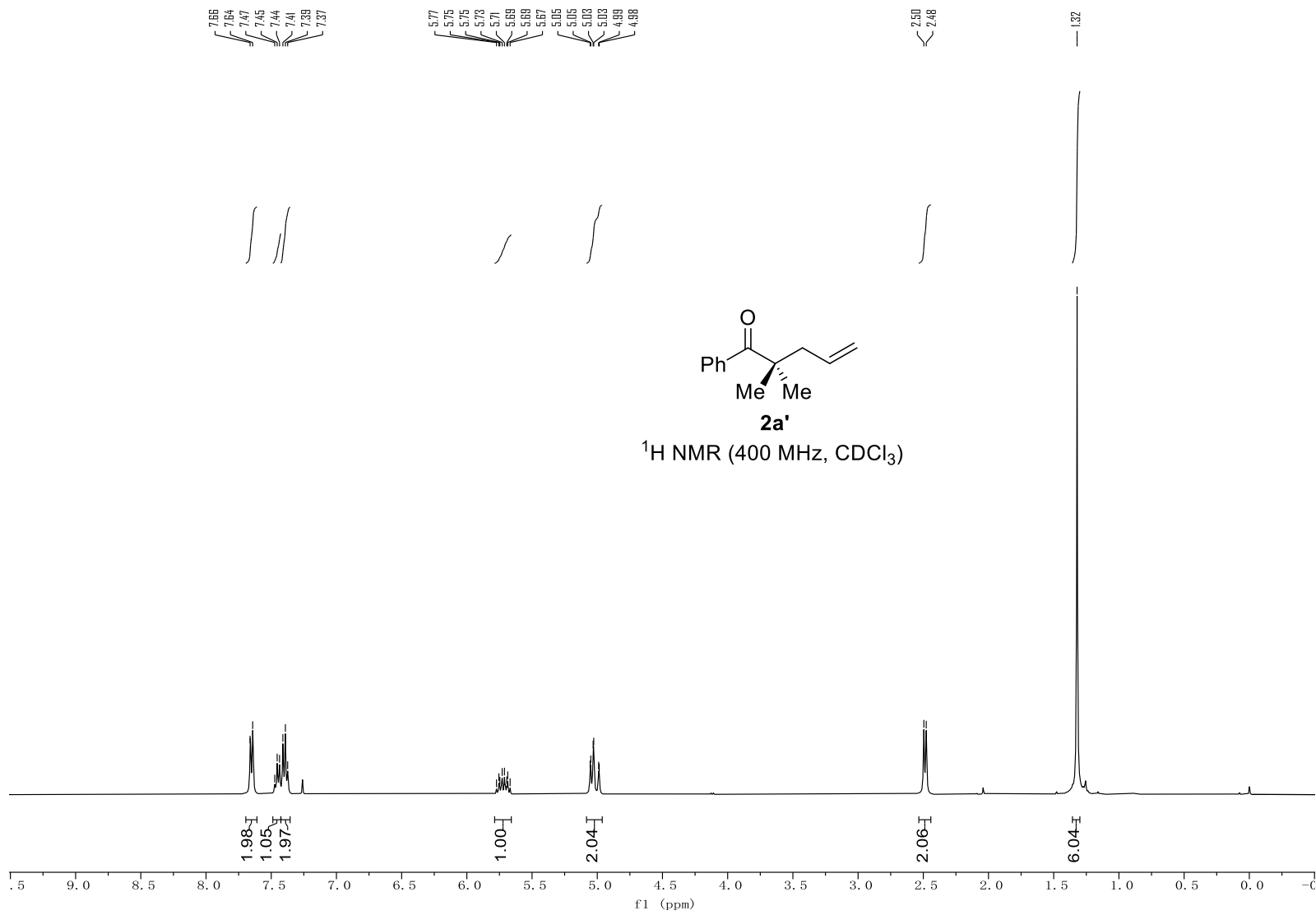


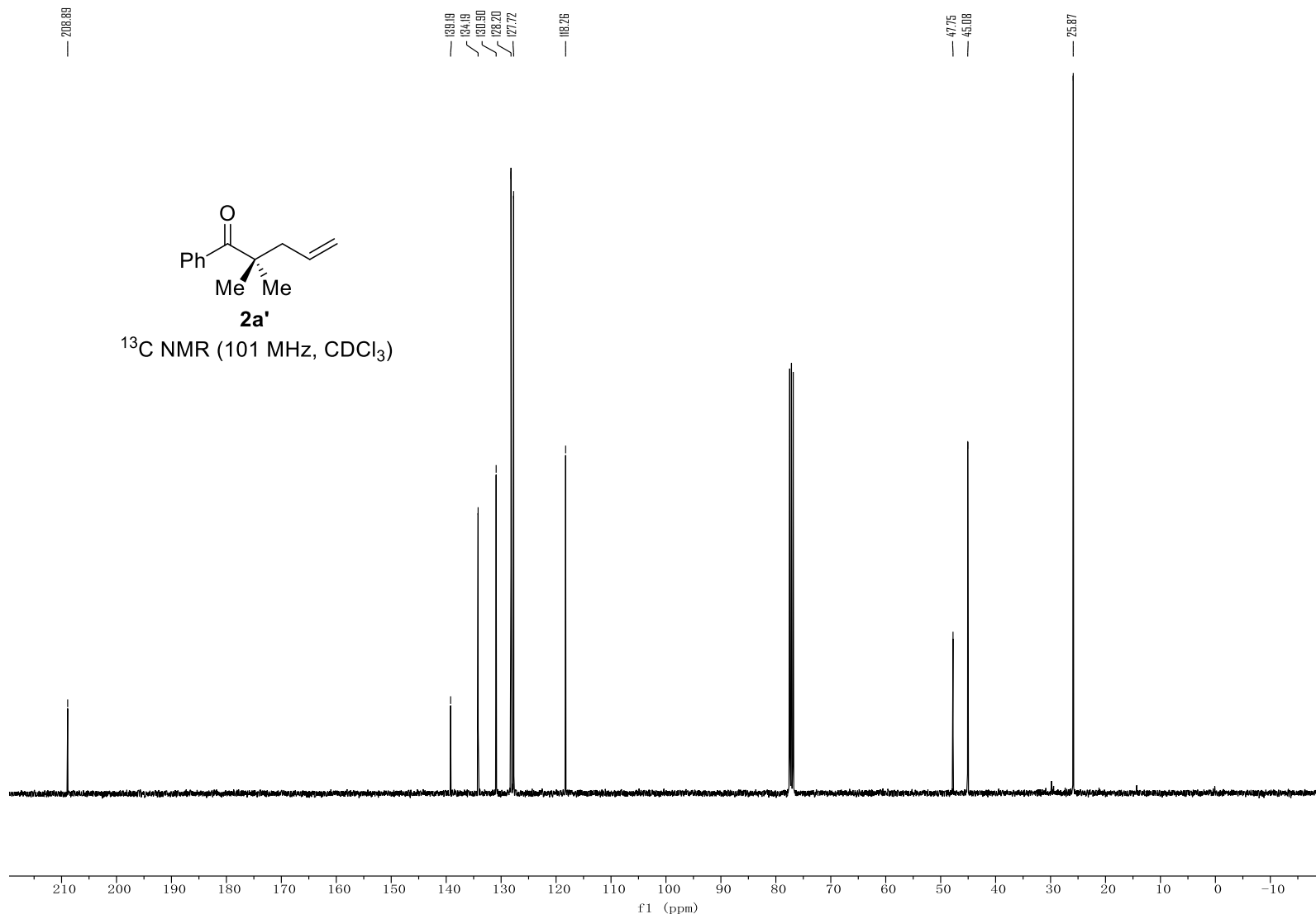




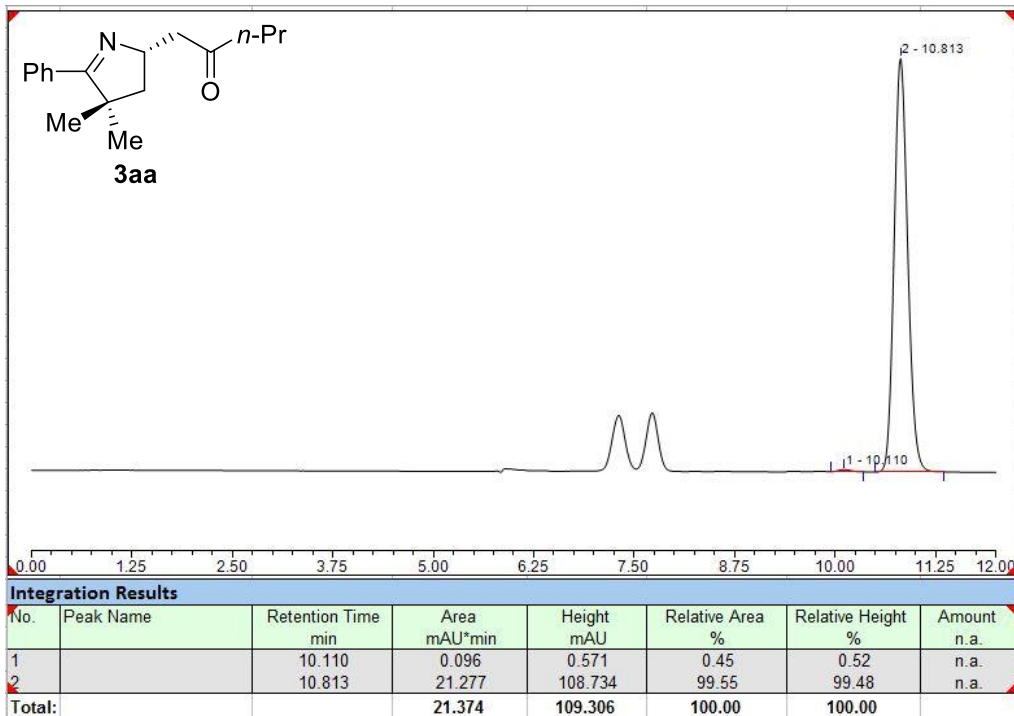
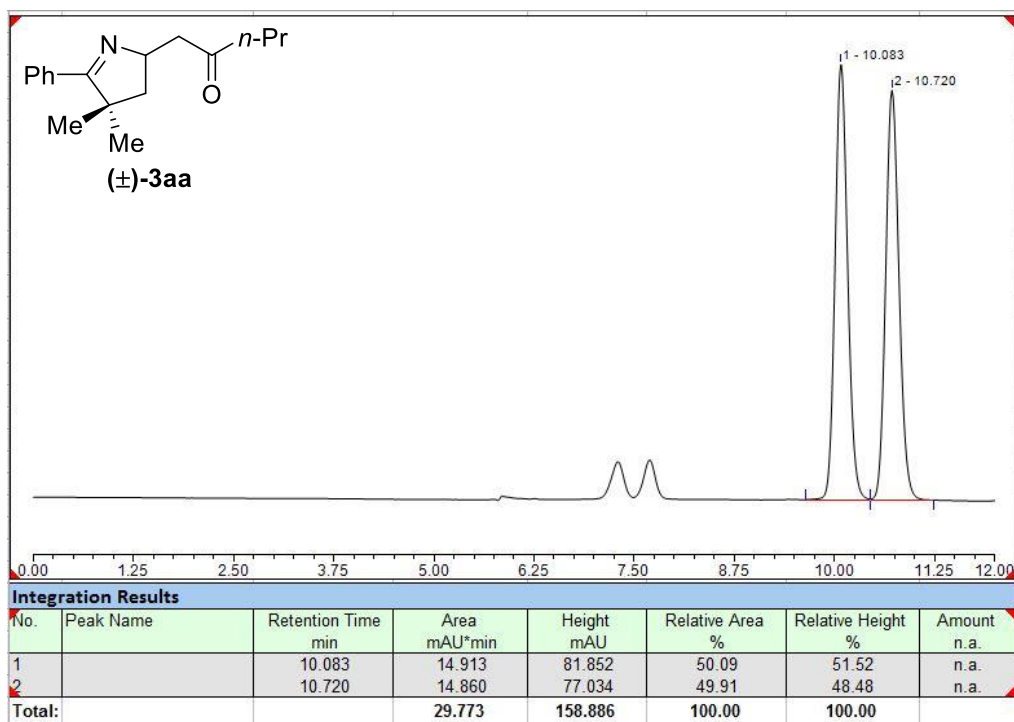
¹³C NMR (101 MHz, CDCl₃)





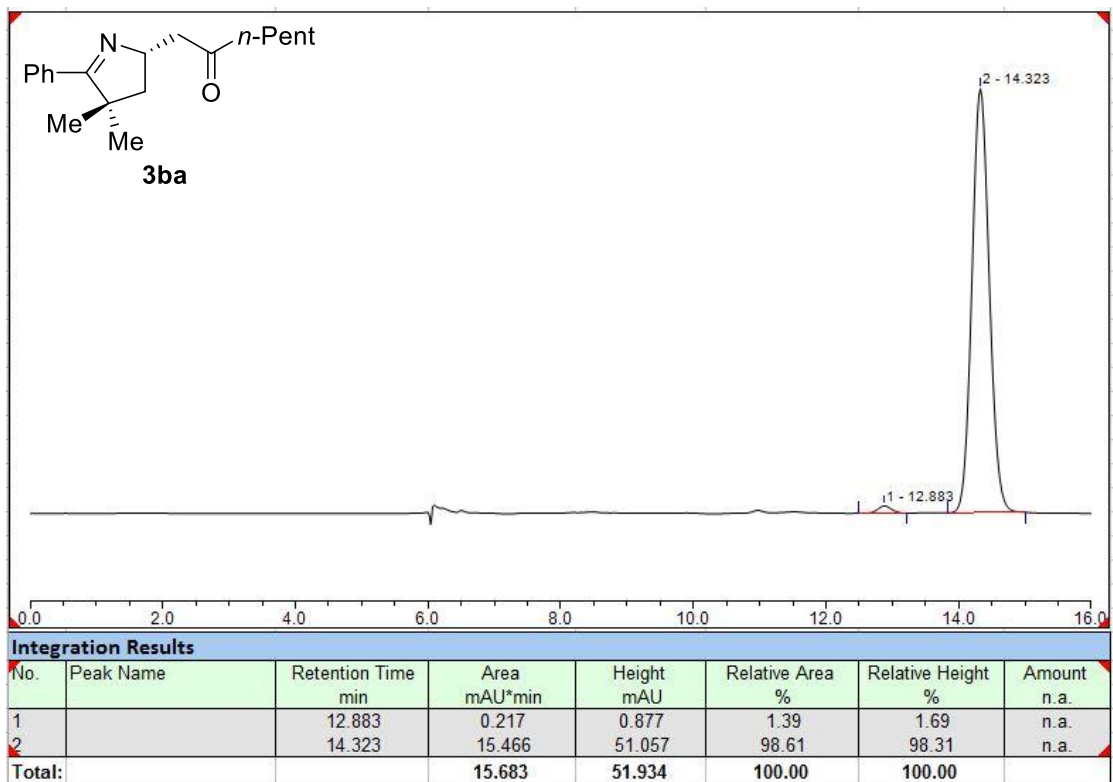
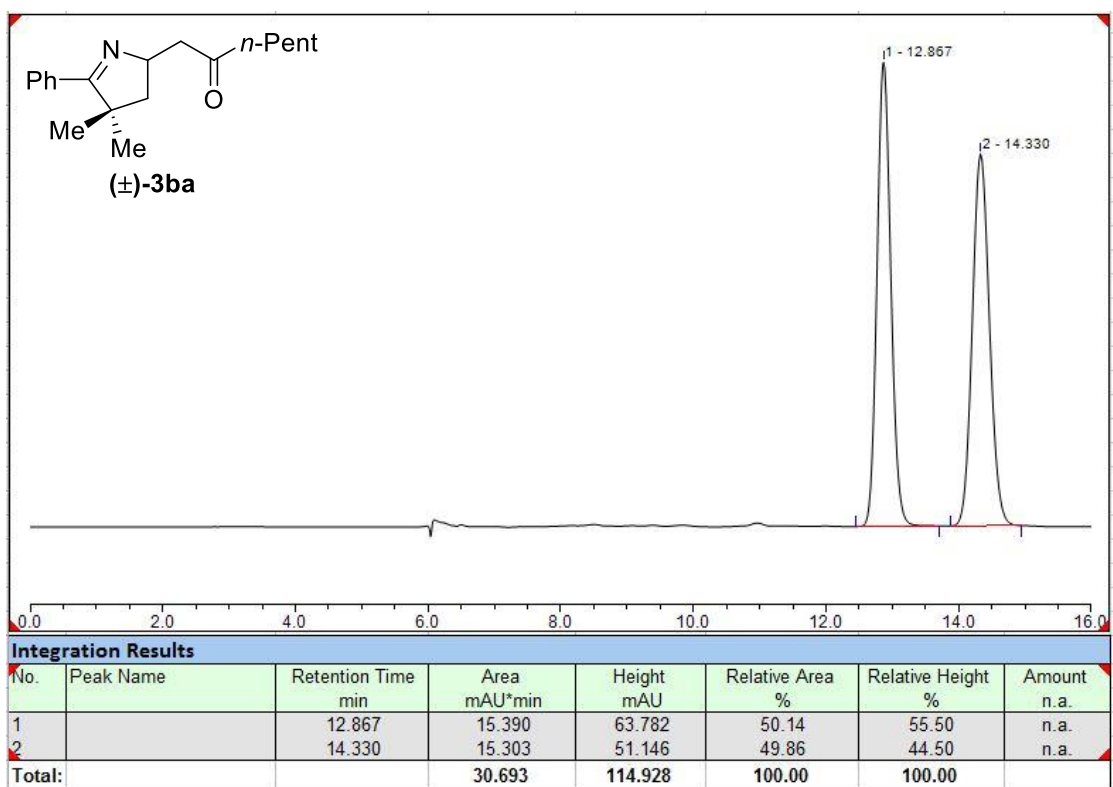


HPLC Chromatograms



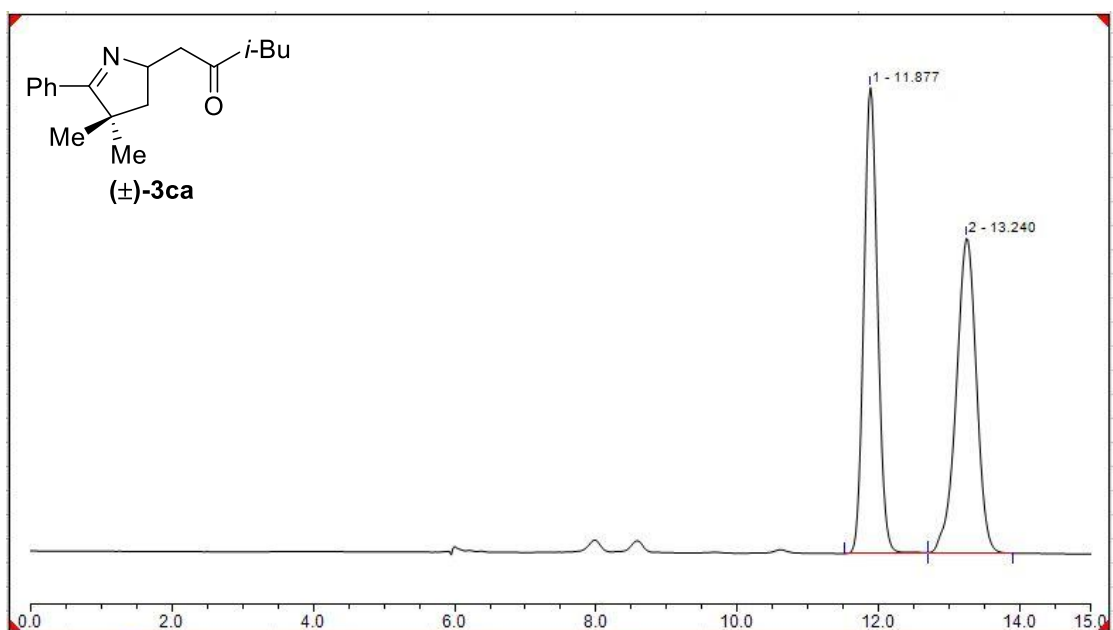
HPLC (Chiral MD): $t_R = 10.1$ (minor), 10.8 (major)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.

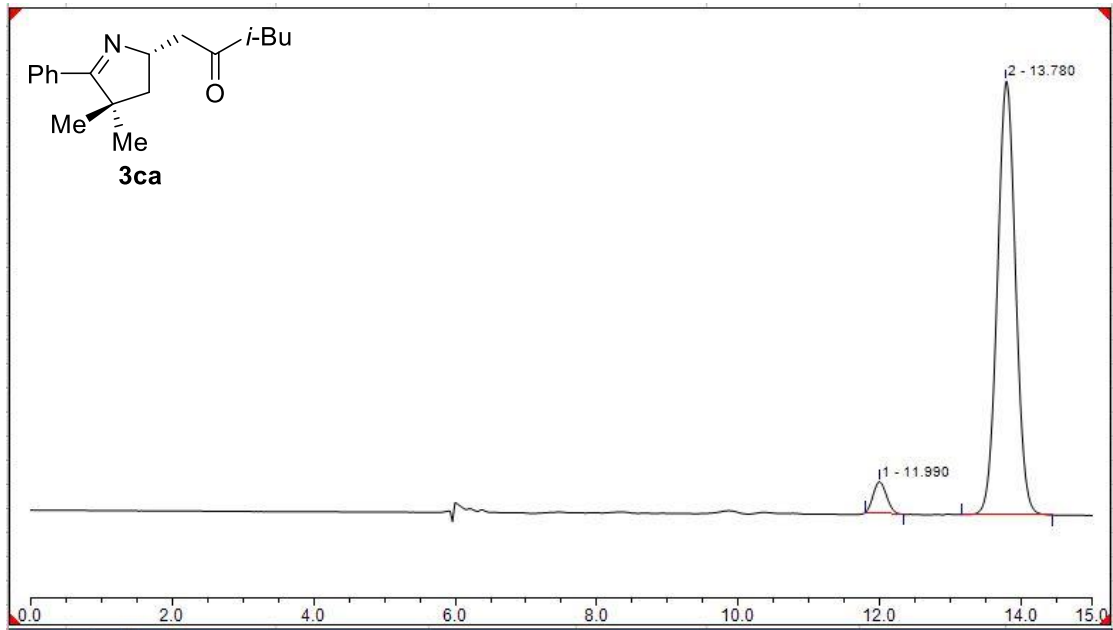


HPLC (Chiral MD): $t_R = 12.9$ (minor), 14.3 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



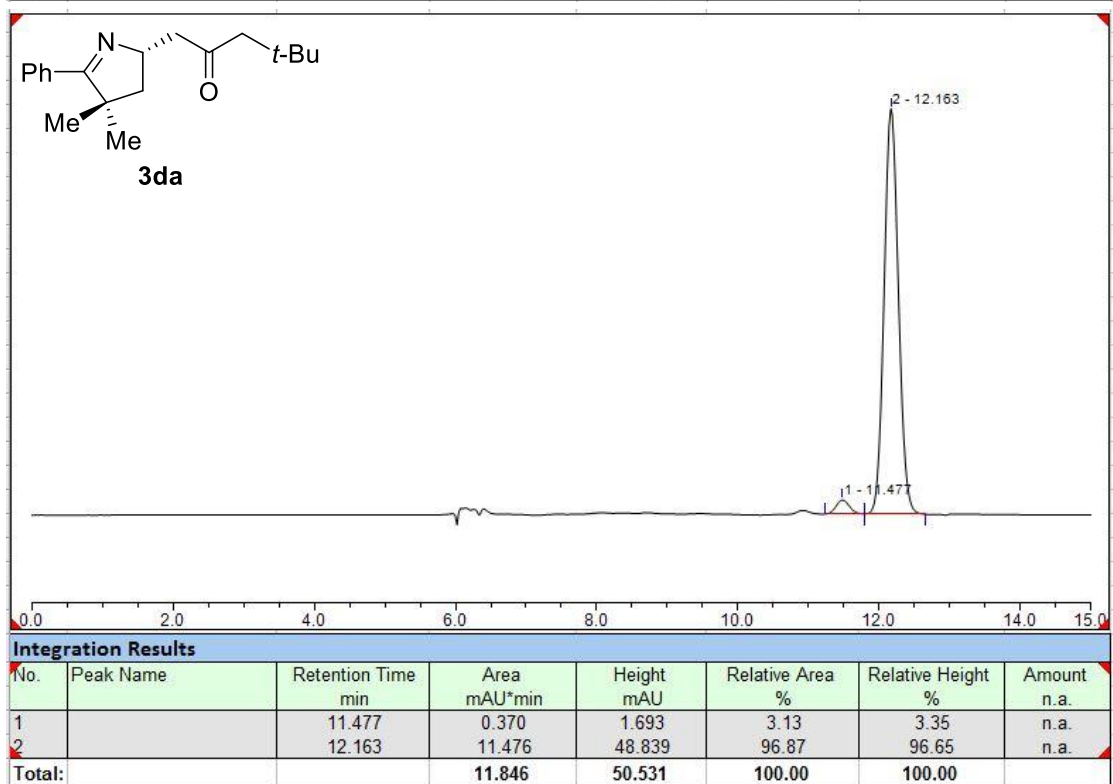
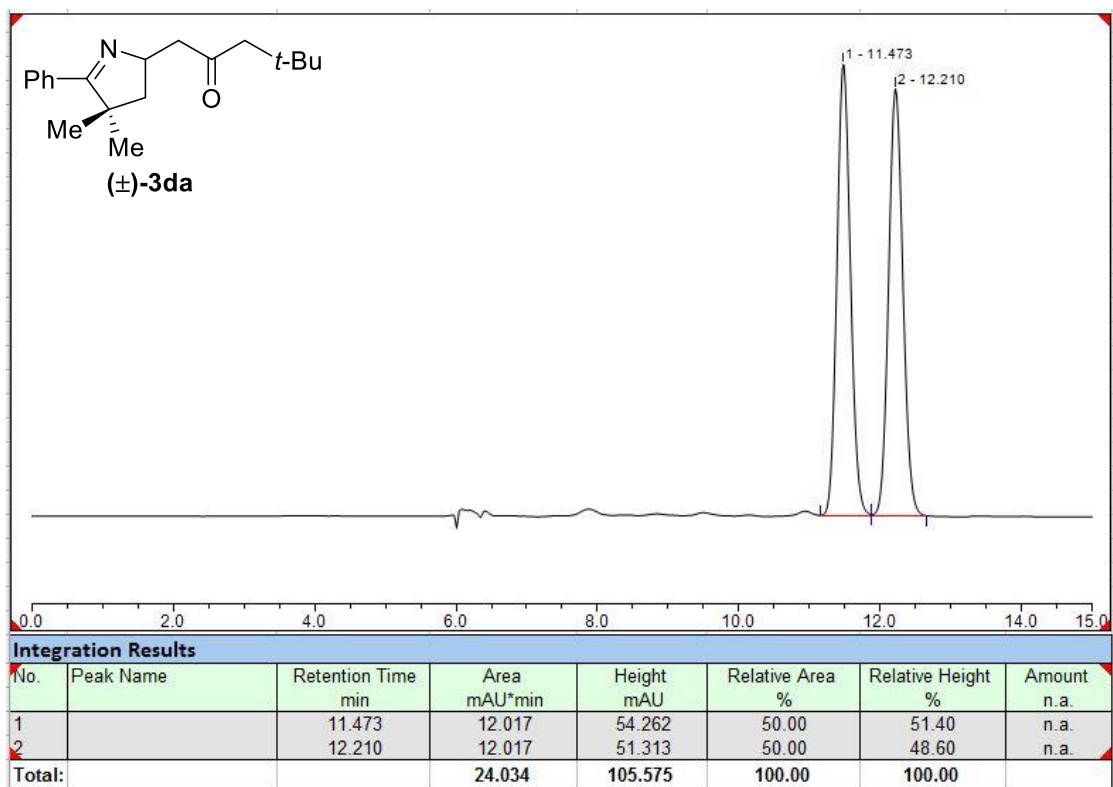
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.877	21.623	96.086	50.08	59.62	n.a.
2		13.240	21.558	65.089	49.92	40.38	n.a.
Total:			43.181	161.175	100.00	100.00	



Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.990	0.812	3.769	4.98	6.74	n.a.
2		13.780	15.510	52.133	95.02	93.26	n.a.
Total:			16.322	55.901	100.00	100.00	

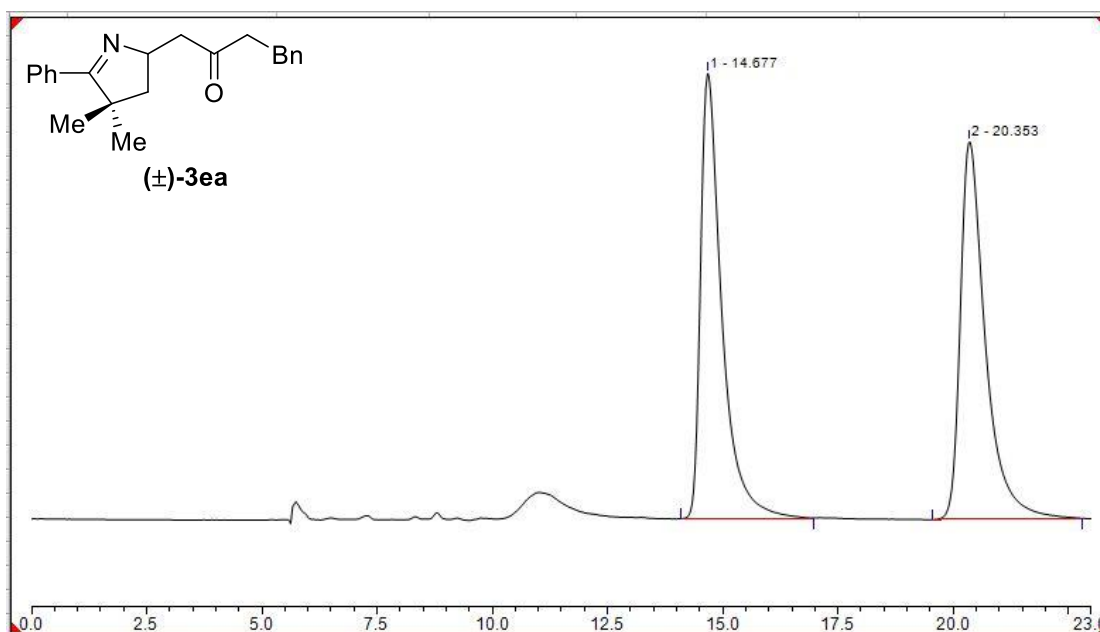
HPLC (Chiral MD): $t_R = 12.0$ (minor), 13.8 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.

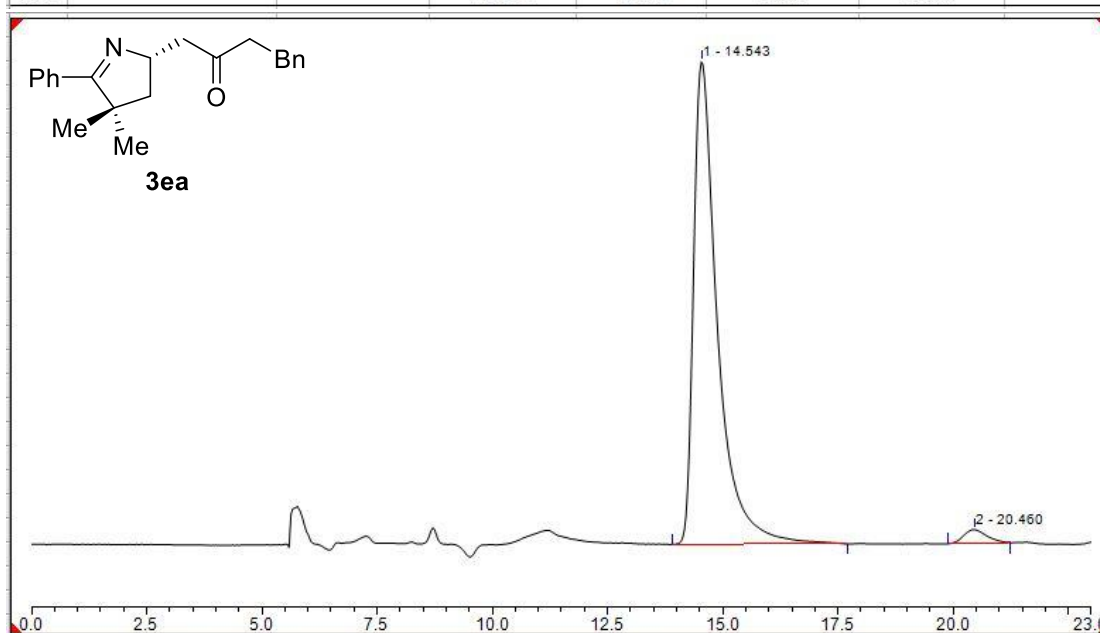


HPLC (Chiral MD): $t_R = 11.5$ (minor), 12.2 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



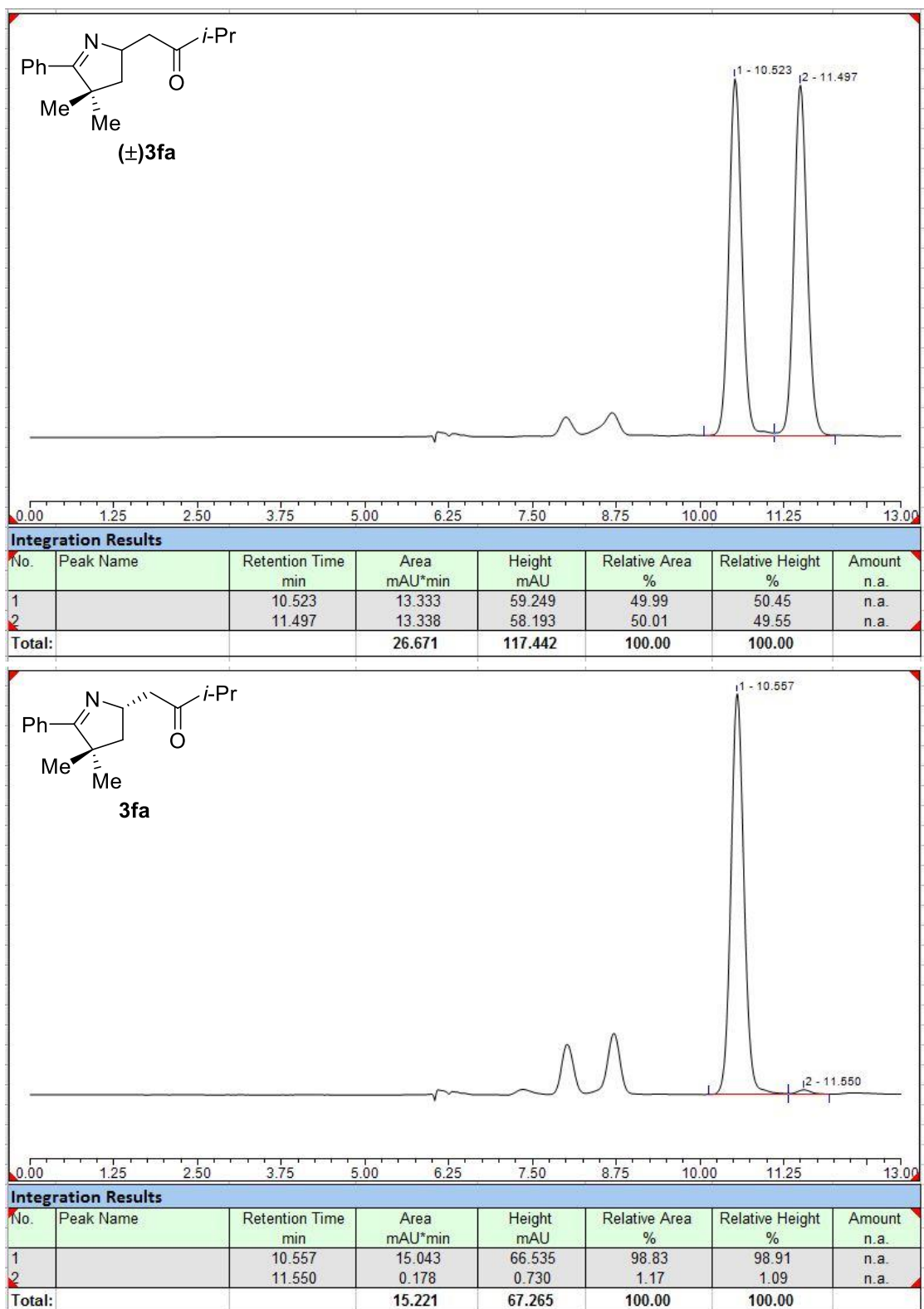
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.677	14.370	26.796	50.05	54.07	n.a.
2		20.353	14.340	22.761	49.95	45.93	n.a.
Total:			28.710	49.557	100.00	100.00	



Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.543	9.999	16.630	97.27	97.20	n.a.
2		20.460	0.281	0.479	2.73	2.80	n.a.
Total:			10.279	17.109	100.00	100.00	

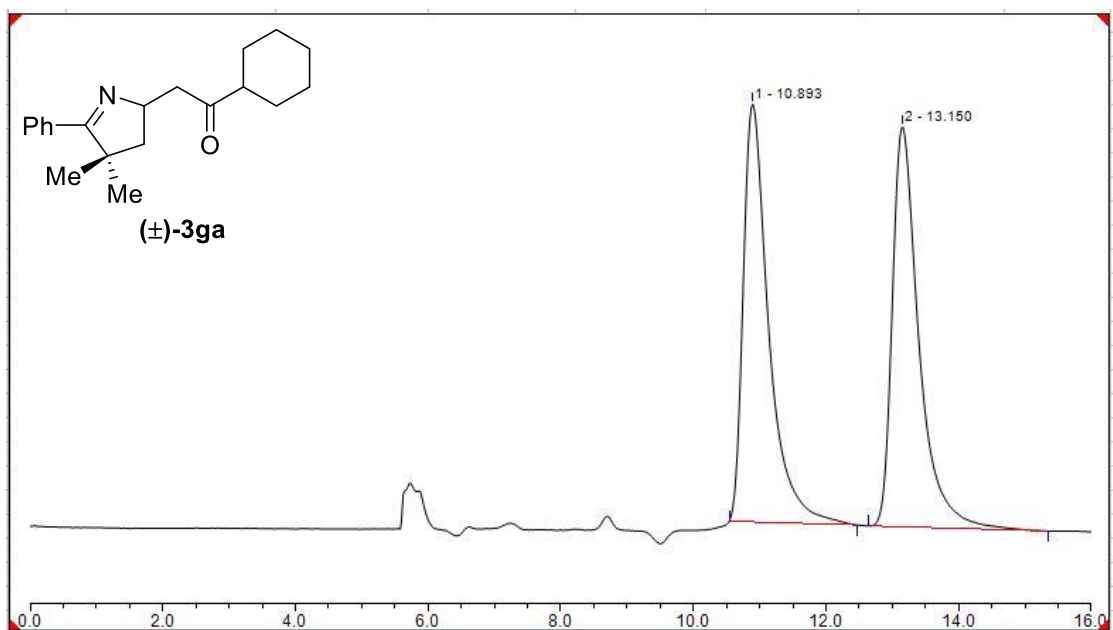
HPLC (Chiralpak IA): $t_R = 14.5$ (major), 20.5 (minor)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.

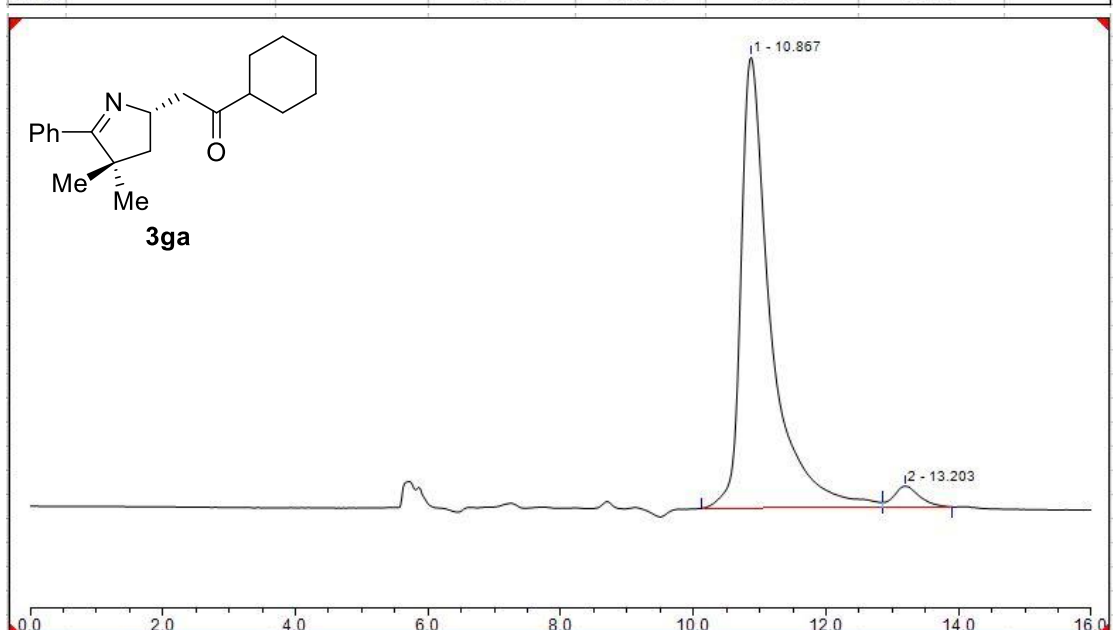


HPLC (Chiral MD): $t_R = 10.6$ (major), 11.6 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



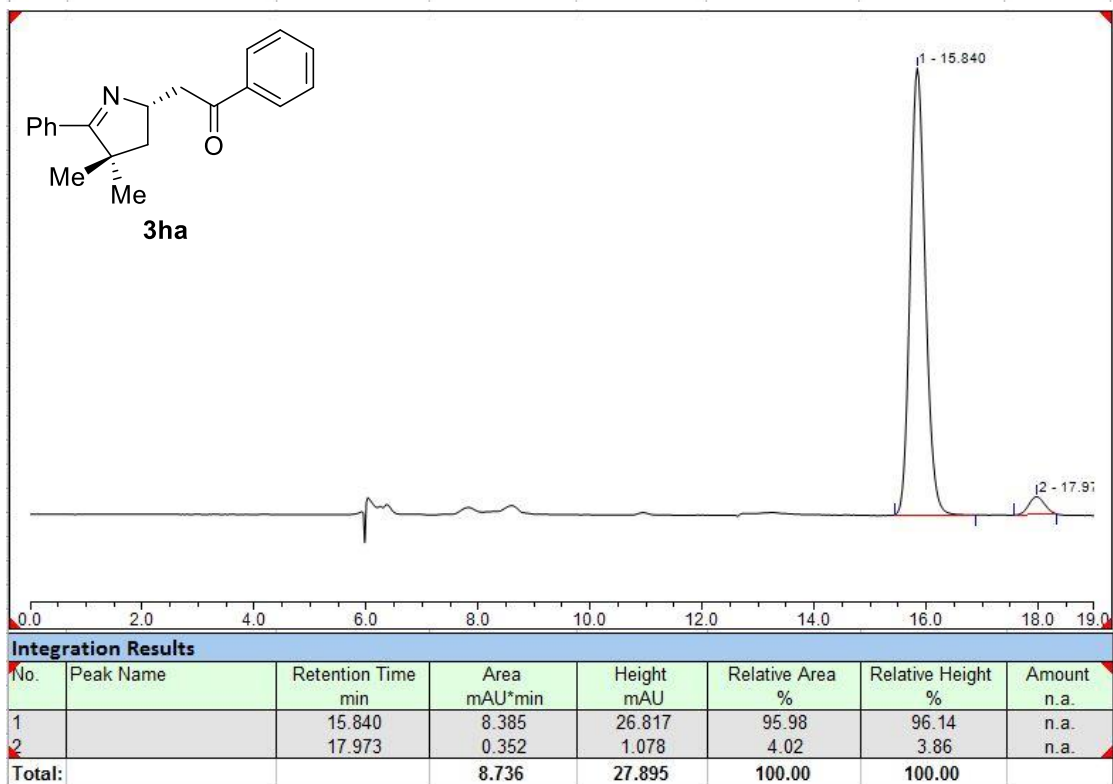
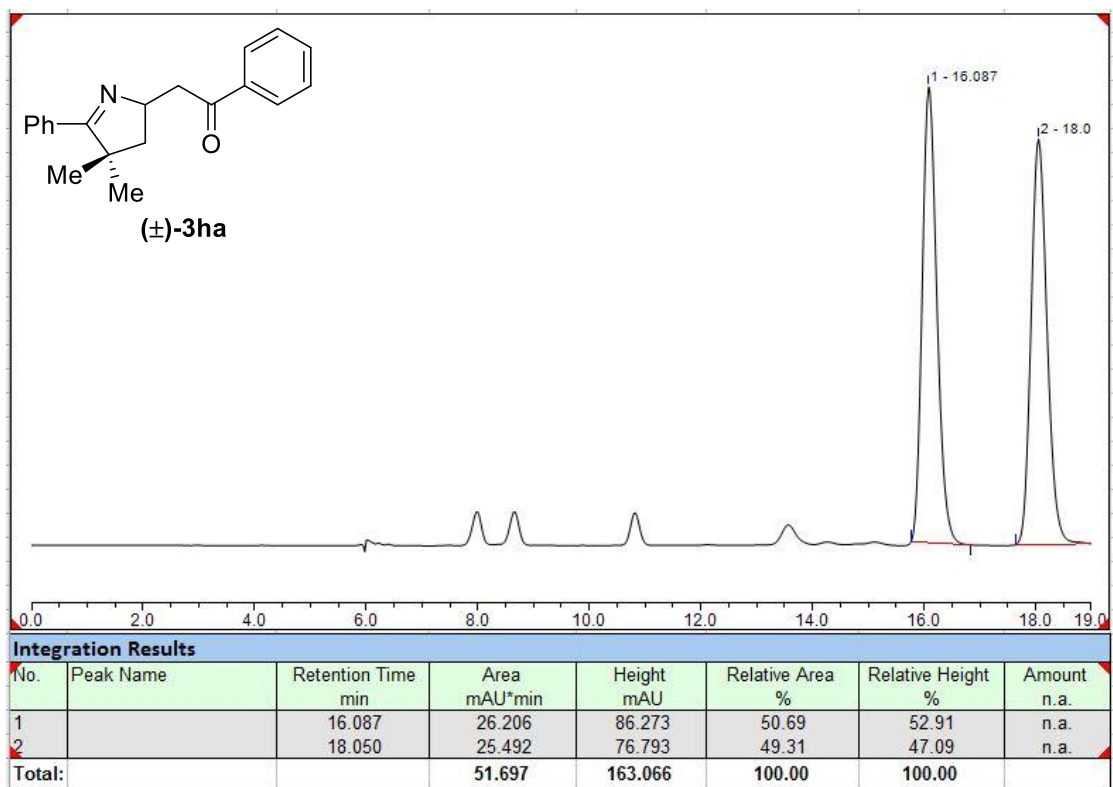
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.893	5.112	11.494	49.95	51.07	n.a.
2		13.150	5.121	11.014	50.05	48.93	n.a.
Total:			10.233	22.508	100.00	100.00	



Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.867	12.085	23.249	96.08	95.53	n.a.
2		13.203	0.493	1.087	3.92	4.47	n.a.
Total:			12.578	24.336	100.00	100.00	

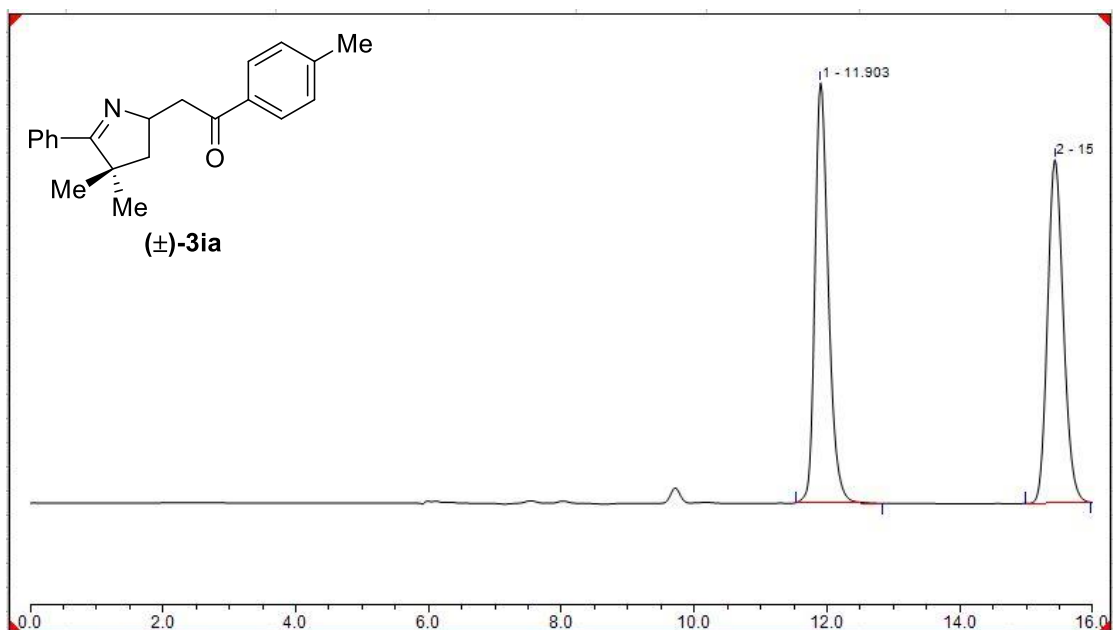
HPLC (Chiralpak IA): $t_R = 10.9$ (major), 13.2 (minor)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.

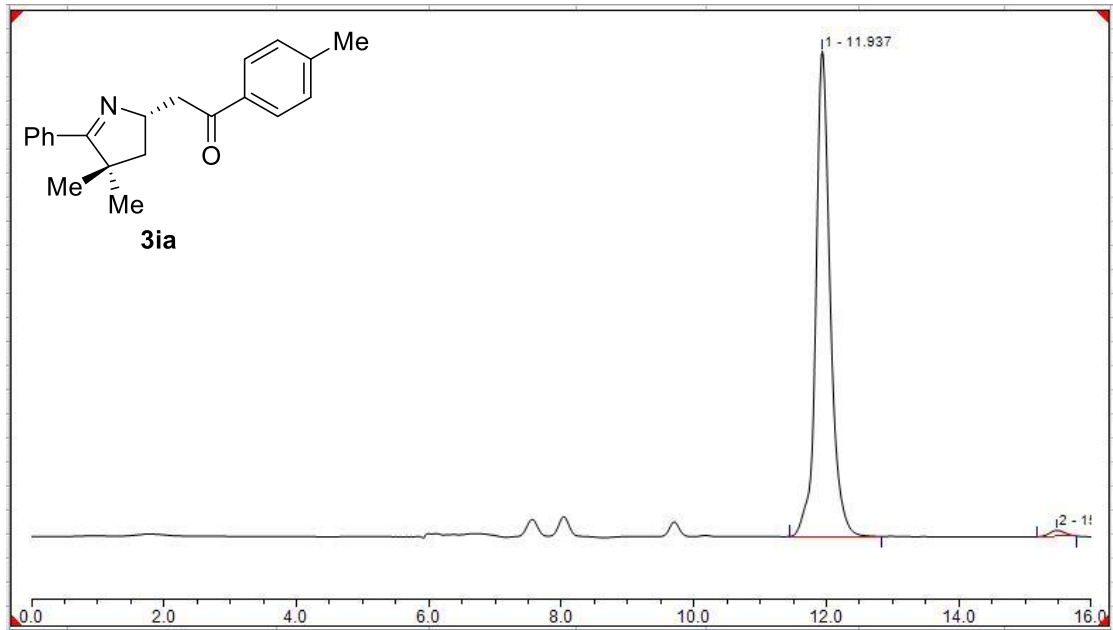


HPLC (Chiral MD): $t_R = 15.8$ (major), 18.0 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



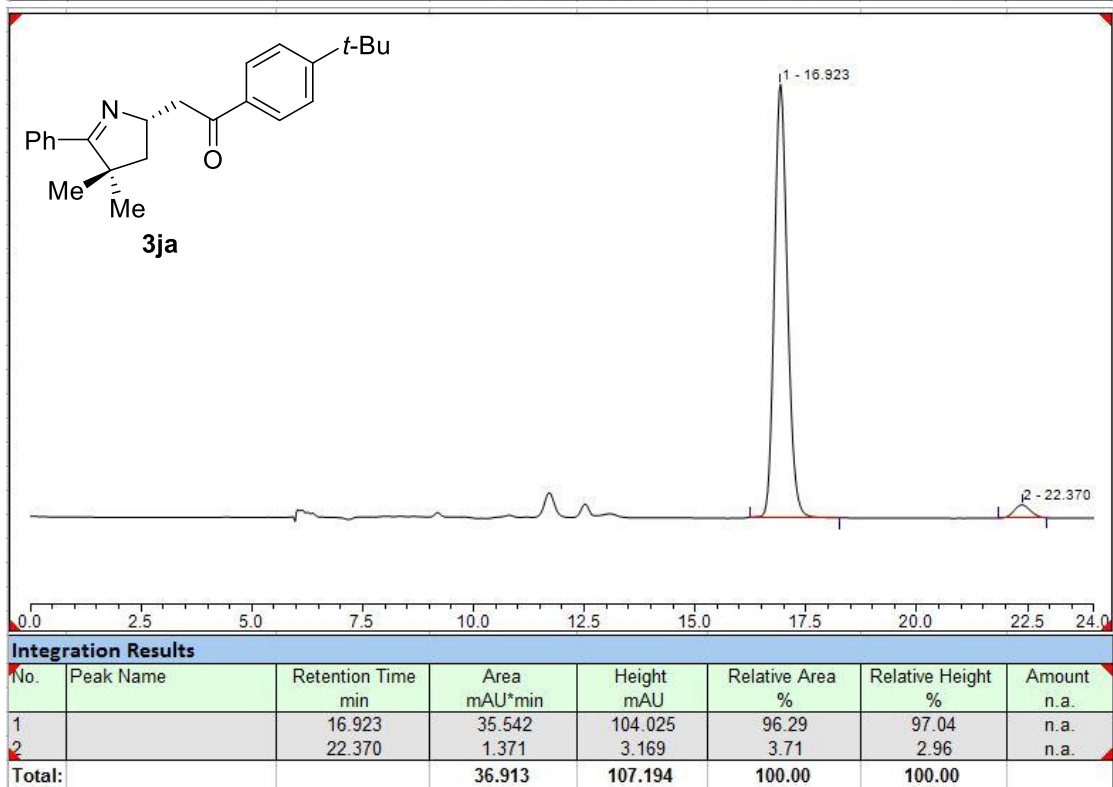
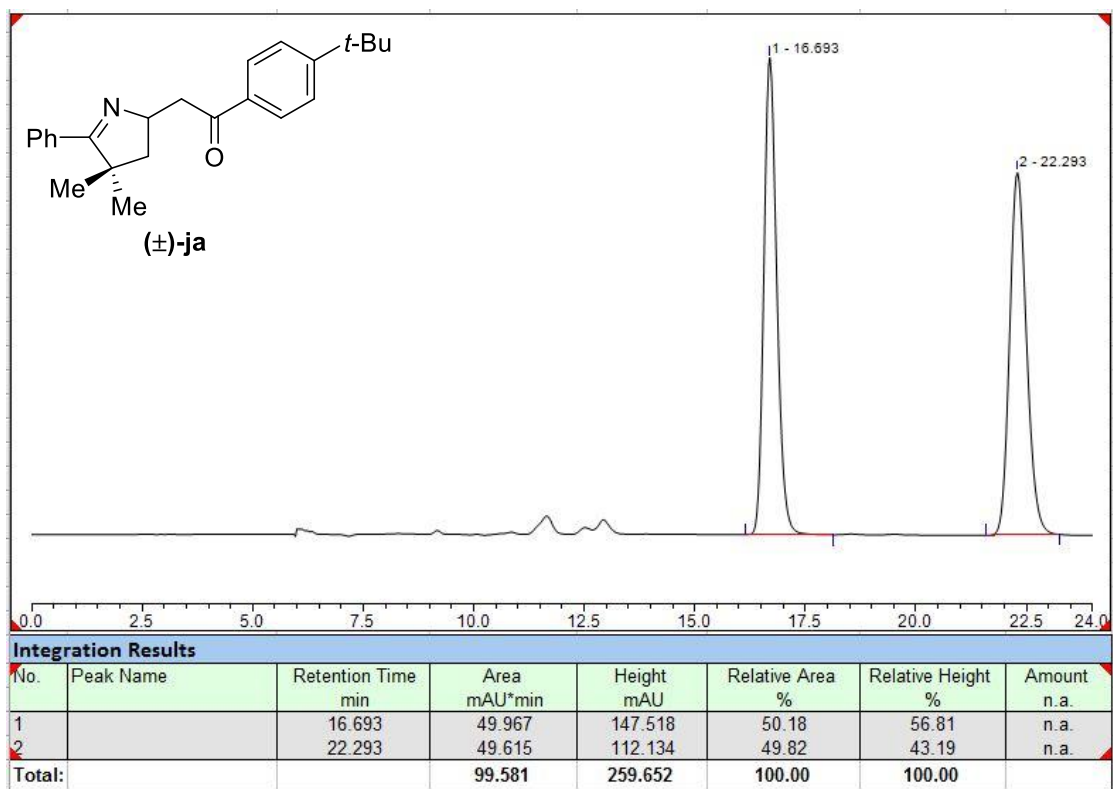
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.903	50.707	216.068	50.91	55.02	n.a.
2		15.430	48.895	176.663	49.09	44.98	n.a.
Total:			99.601	392.732	100.00	100.00	



Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.937	41.903	166.995	98.70	98.78	n.a.
2		15.480	0.553	2.059	1.30	1.22	n.a.
Total:			42.456	169.054	100.00	100.00	

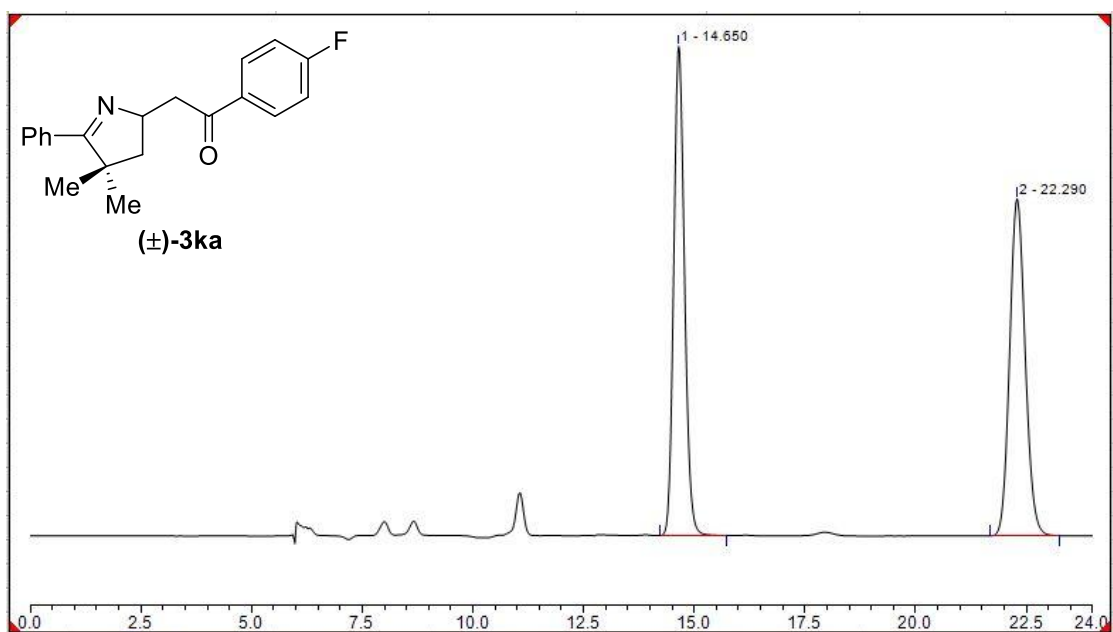
HPLC (Chiral MD): $t_R = 11.9$ (major), 15.5 (minor)

Condition: 92:8, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.

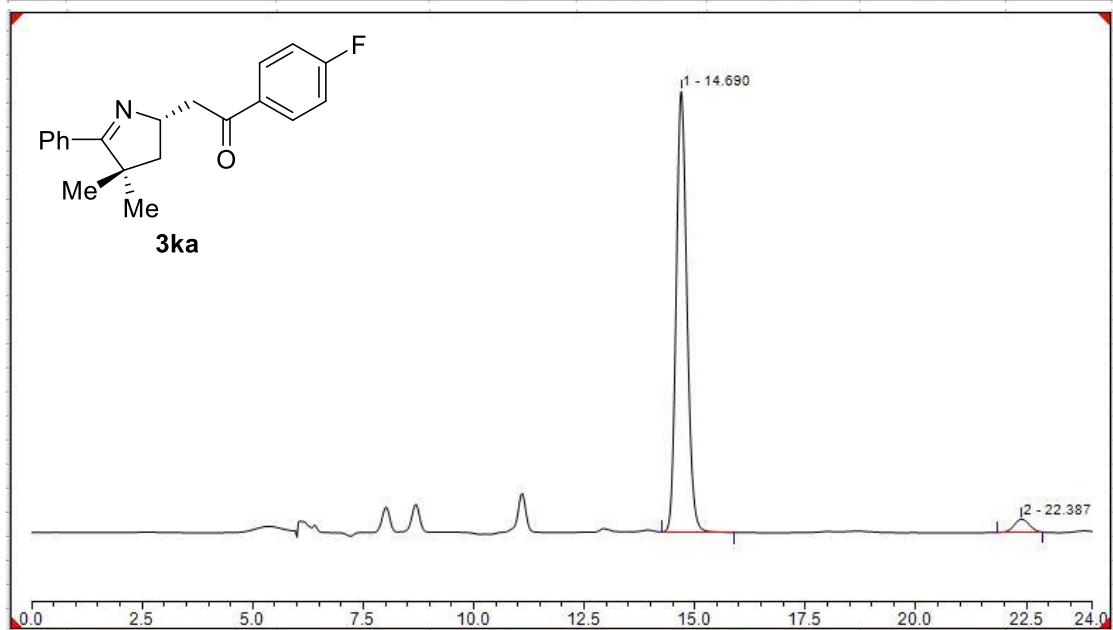


HPLC (Chiral MD): $t_R = 16.9$ (major), 22.4 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



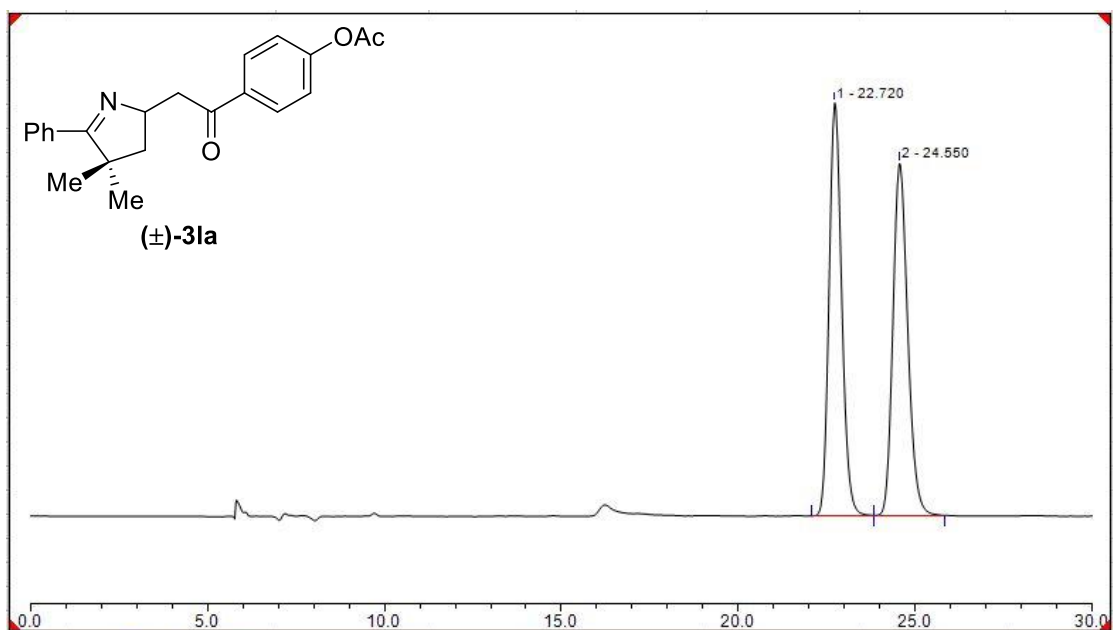
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.650	21.291	75.558	50.15	59.21	n.a.
2		22.290	21.159	52.058	49.85	40.79	n.a.
Total:			42.450	127.616	100.00	100.00	



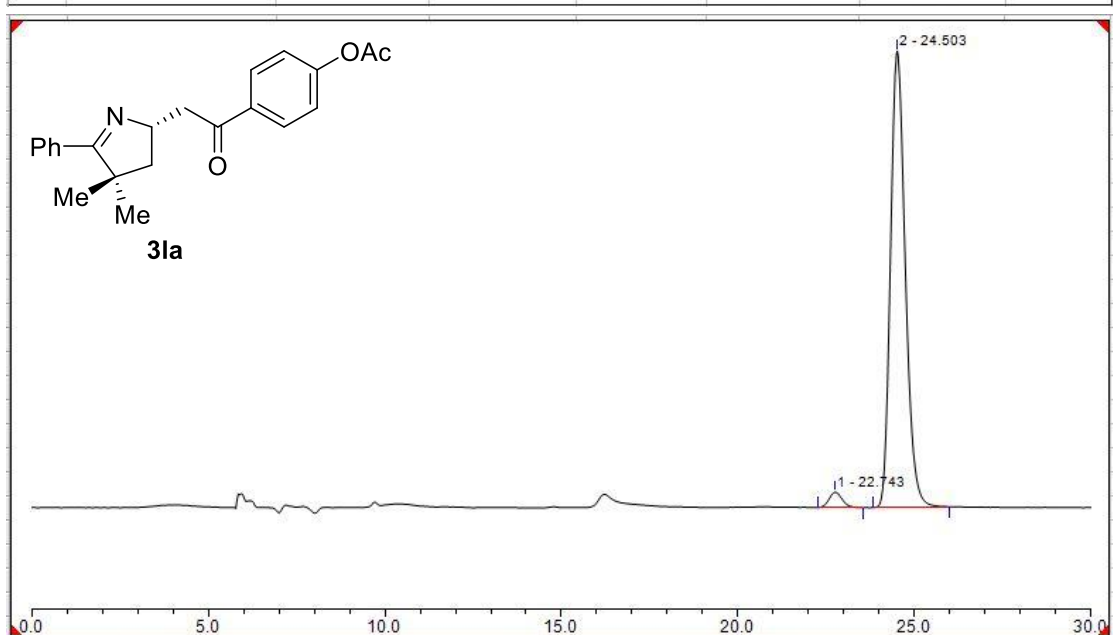
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.690	19.130	68.224	95.96	97.10	n.a.
2		22.387	0.805	2.036	4.04	2.90	n.a.
Total:			19.935	70.260	100.00	100.00	

HPLC (Chiral MD): $t_R = 14.7$ (major), 22.4 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



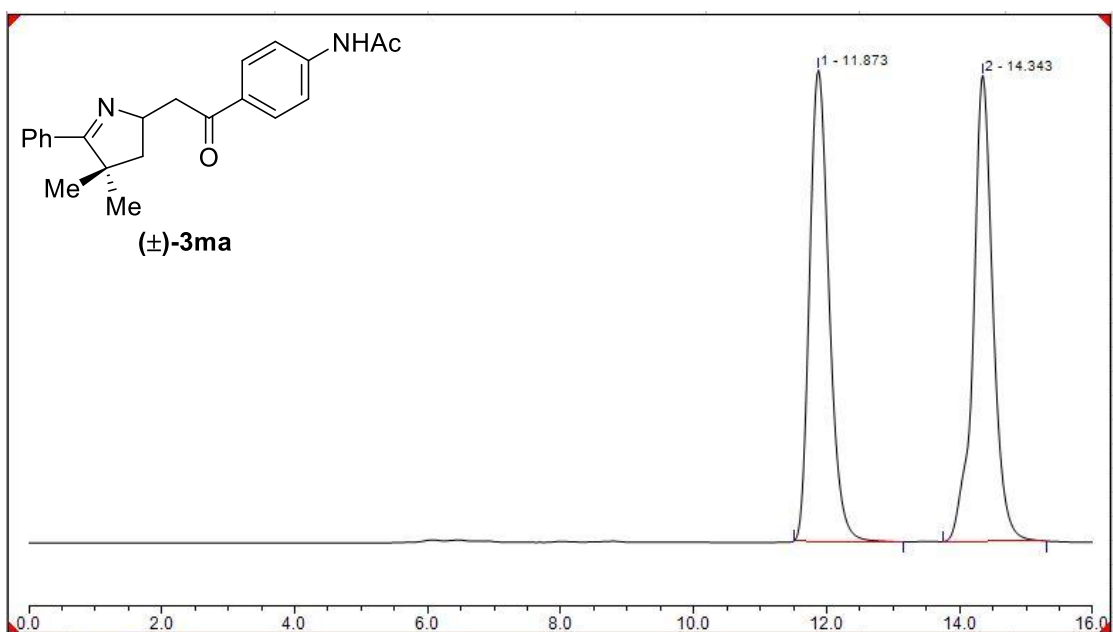
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		22.720	10.266	24.823	50.03	53.98	n.a.
2		24.550	10.253	21.159	49.97	46.02	n.a.
Total:			20.519	45.983	100.00	100.00	



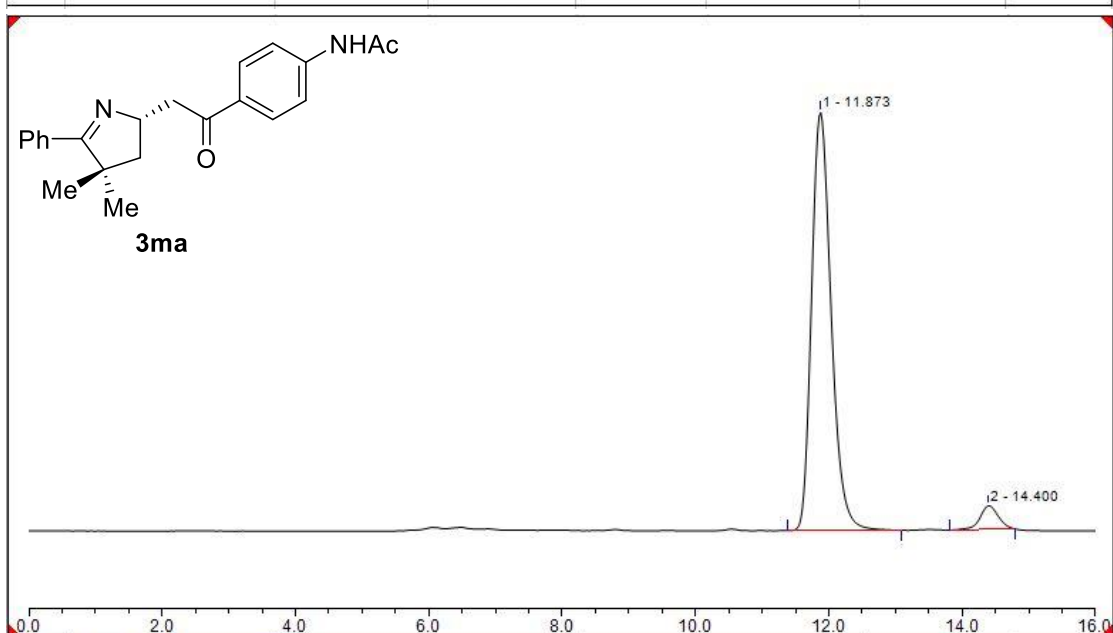
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		22.743	0.348	0.804	2.96	3.30	n.a.
2		24.503	11.406	23.555	97.04	96.70	n.a.
Total:			11.753	24.359	100.00	100.00	

HPLC (Chiral MD): $t_R = 22.7$ (minor), 24.5 (major)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



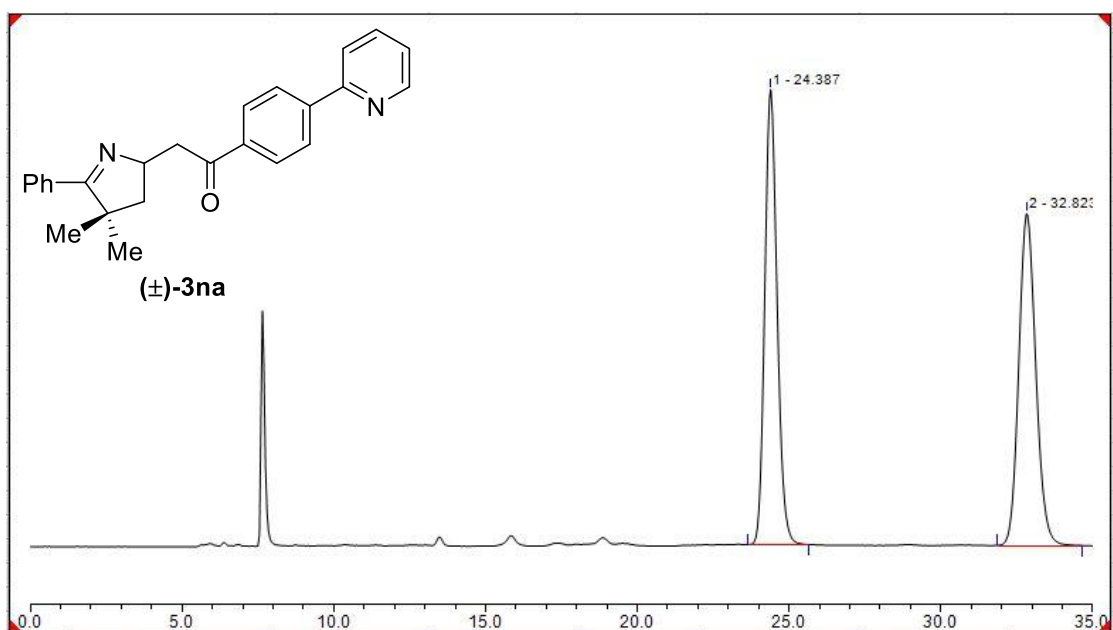
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.873	27.359	80.802	50.08	50.30	n.a.
2		14.343	27.274	79.842	49.92	49.70	n.a.
Total:			54.633	160.644	100.00	100.00	



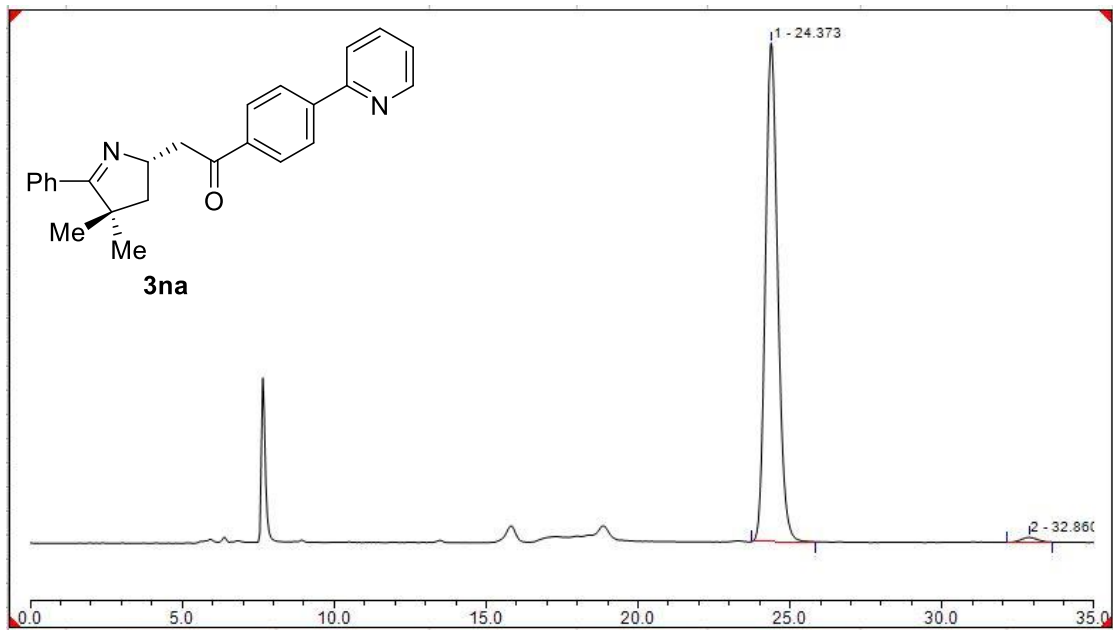
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.873	19.476	57.242	94.98	94.65	n.a.
2		14.400	1.030	3.234	5.02	5.35	n.a.
Total:			20.505	60.475	100.00	100.00	

HPLC (Chiral MD): $t_R = 11.9$ (major), 14.4 (minor)

Condition: 80:20, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



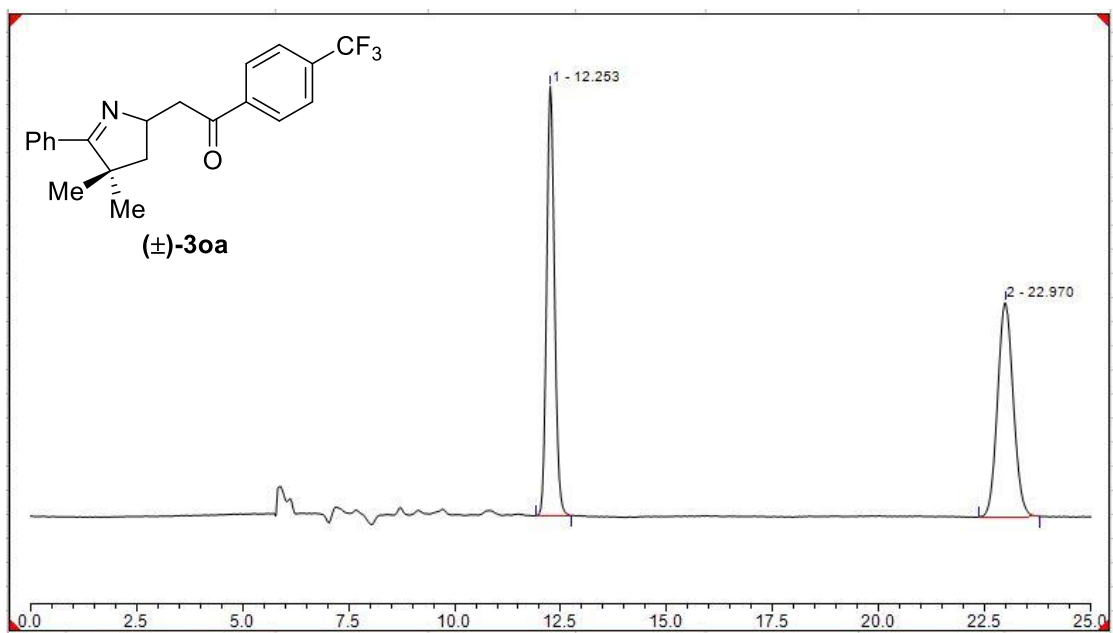
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		24.387	8.094	17.185	49.88	57.82	n.a.
2		32.823	8.133	12.536	50.12	42.18	n.a.
Total:			16.228	29.722	100.00	100.00	



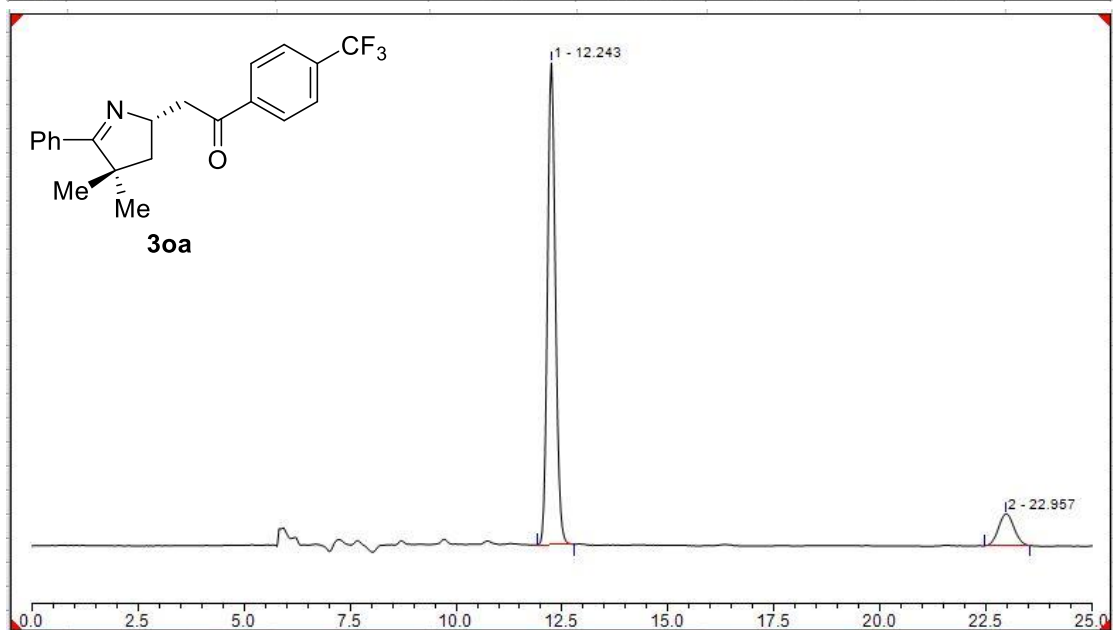
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		24.373	8.839	18.828	98.62	98.97	n.a.
2		32.860	0.124	0.196	1.38	1.03	n.a.
Total:			8.963	19.025	100.00	100.00	

HPLC (Chiral MD): $t_R = 24.4$ (major), 32.9 (minor)

Condition: 80:20, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



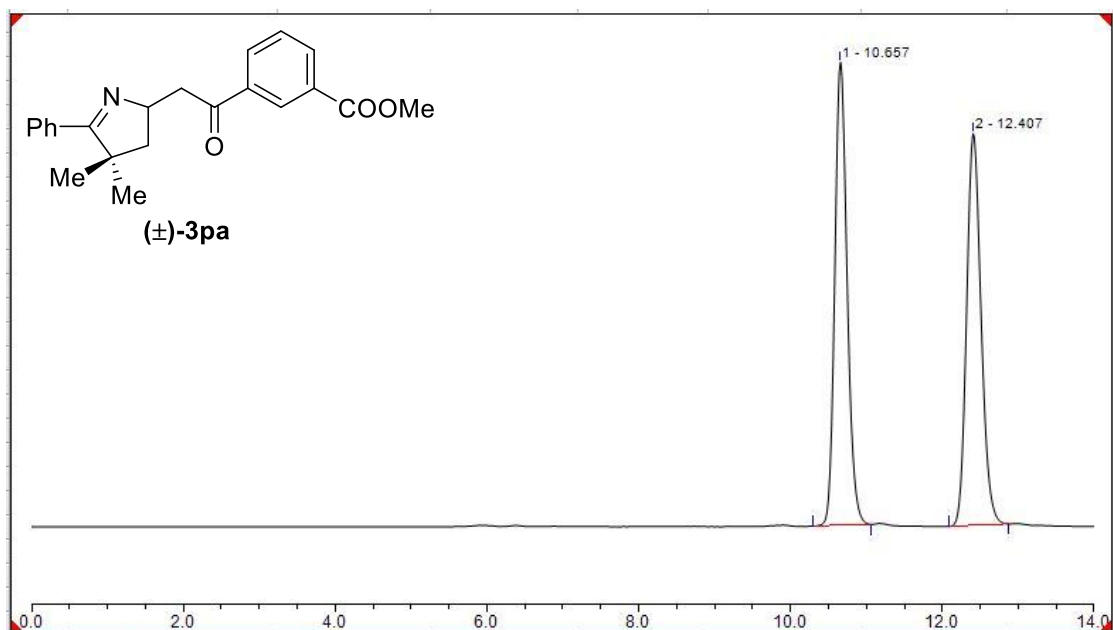
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		12.253	2.220	10.326	49.98	66.70	n.a.
2		22.970	2.221	5.155	50.02	33.30	n.a.
Total:			4.441	15.480	100.00	100.00	



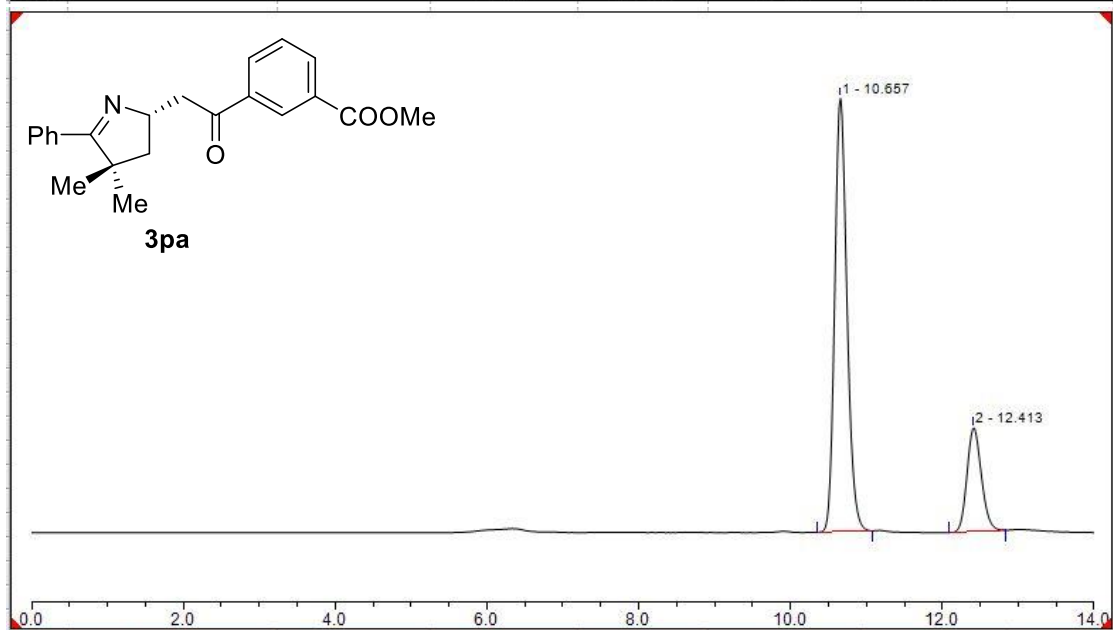
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		12.243	3.940	18.217	88.31	93.75	n.a.
2		22.957	0.521	1.214	11.69	6.25	n.a.
Total:			4.461	19.431	100.00	100.00	

HPLC (Chiral MD): $t_R = 12.2$ (major), 23.0 (minor)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



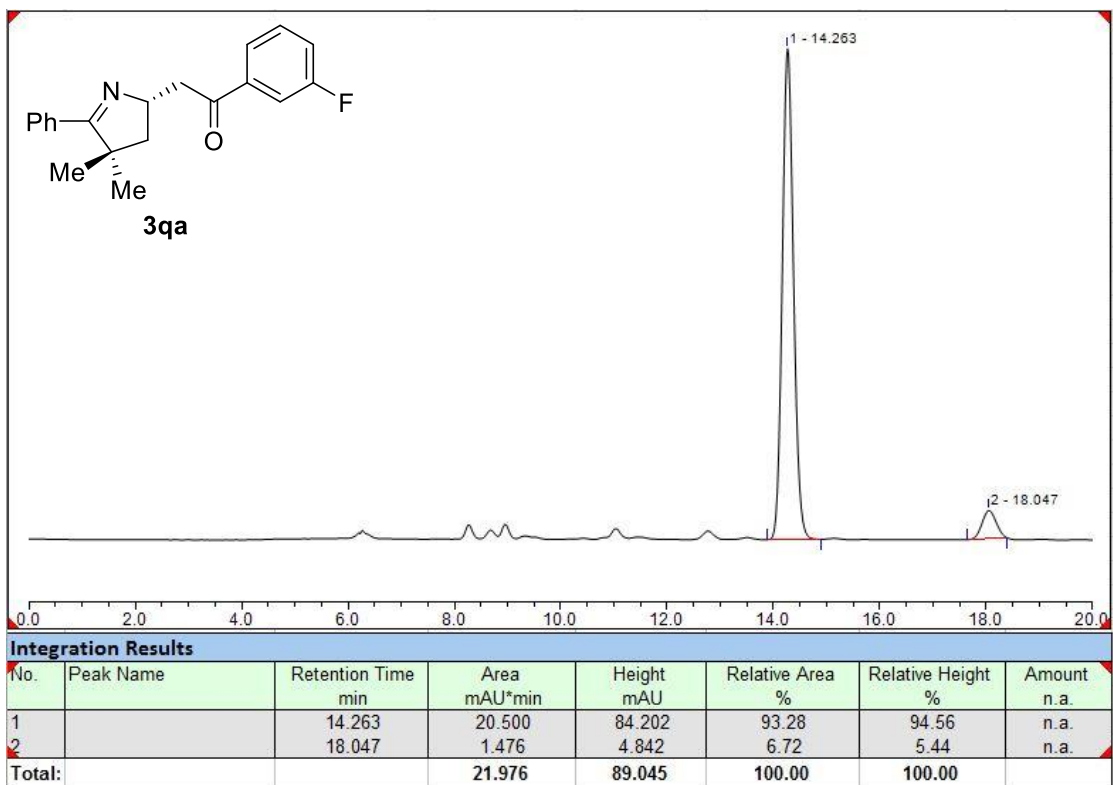
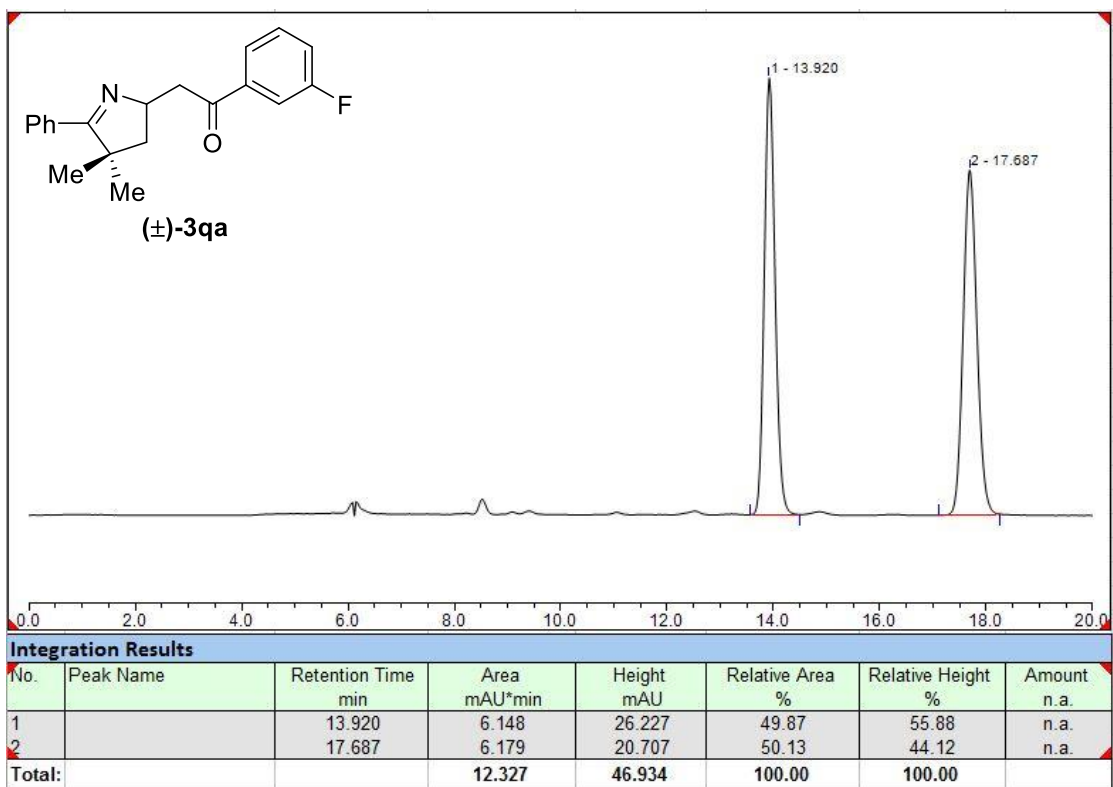
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.657	11.922	63.586	50.13	54.16	n.a.
2		12.407	11.858	53.823	49.87	45.84	n.a.
Total:			23.780	117.408	100.00	100.00	



Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.657	12.506	66.965	78.02	80.66	n.a.
2		12.413	3.523	16.061	21.98	19.34	n.a.
Total:			16.029	83.026	100.00	100.00	

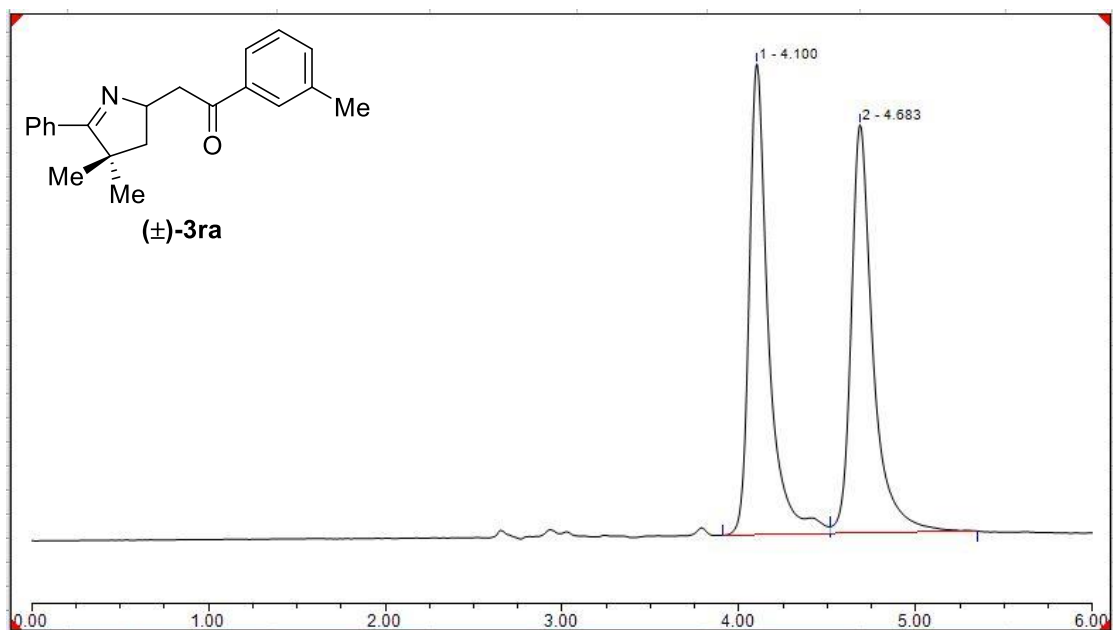
HPLC (Chiral MD): $t_R = 10.7$ (major), 12.4 (minor)

Condition: 80:20, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.

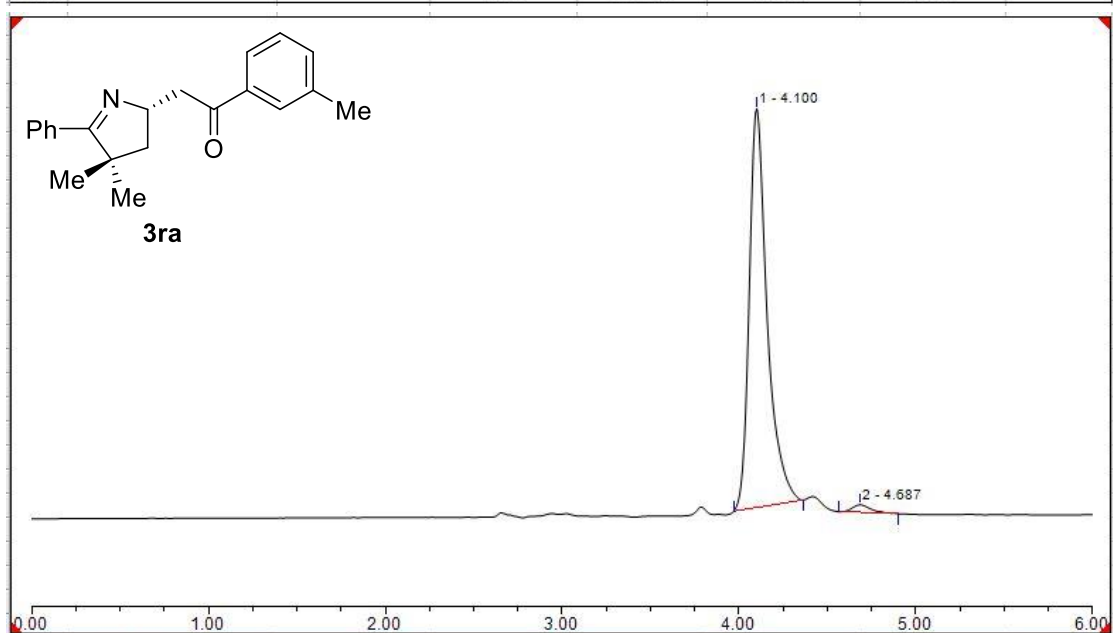


HPLC (Chiral MD): $t_R = 14.3$ (major), 18.0 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



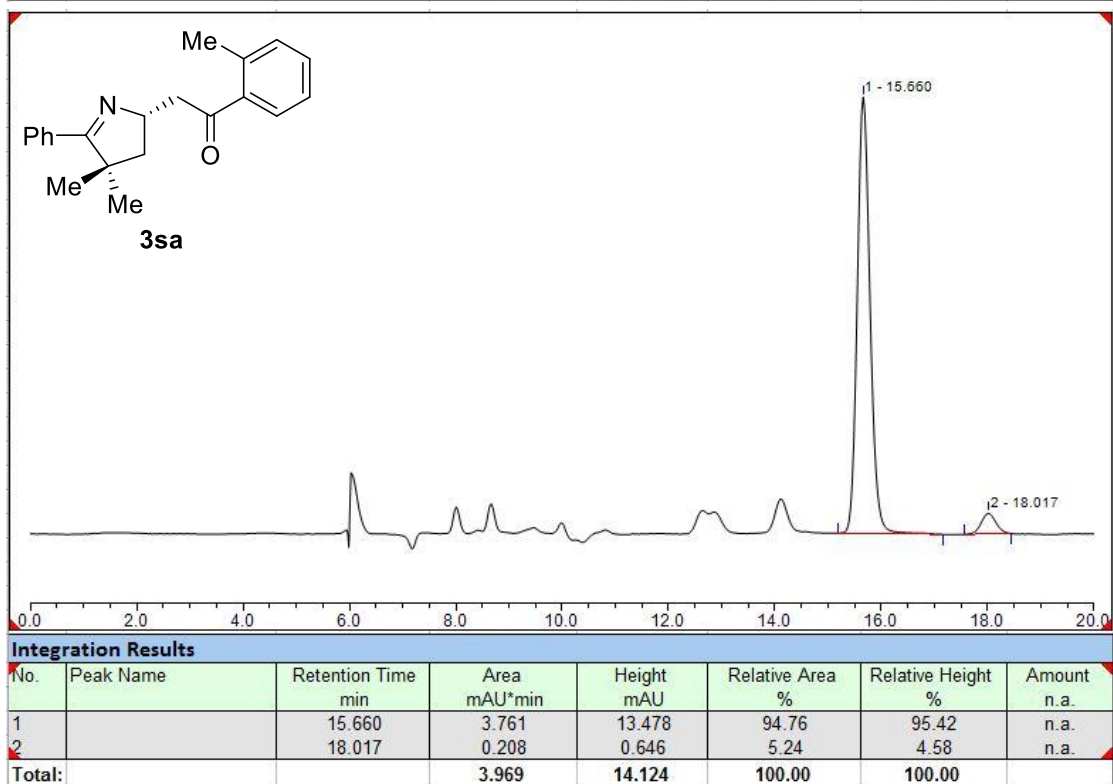
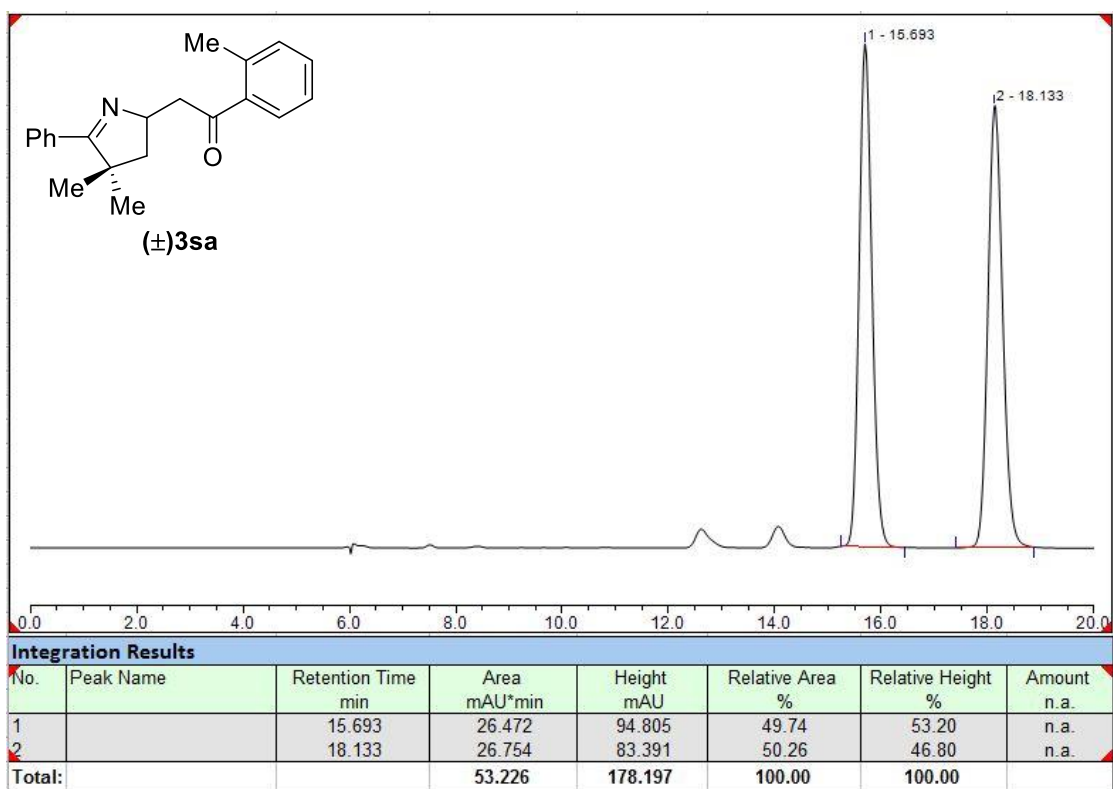
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		4.100	2.048	16.181	50.48	53.55	n.a.
2		4.683	2.009	14.034	49.52	46.45	n.a.
Total:			4.057	30.215	100.00	100.00	



Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		4.100	2.818	24.007	98.09	98.14	n.a.
2		4.687	0.055	0.456	1.91	1.86	n.a.
Total:			2.873	24.462	100.00	100.00	

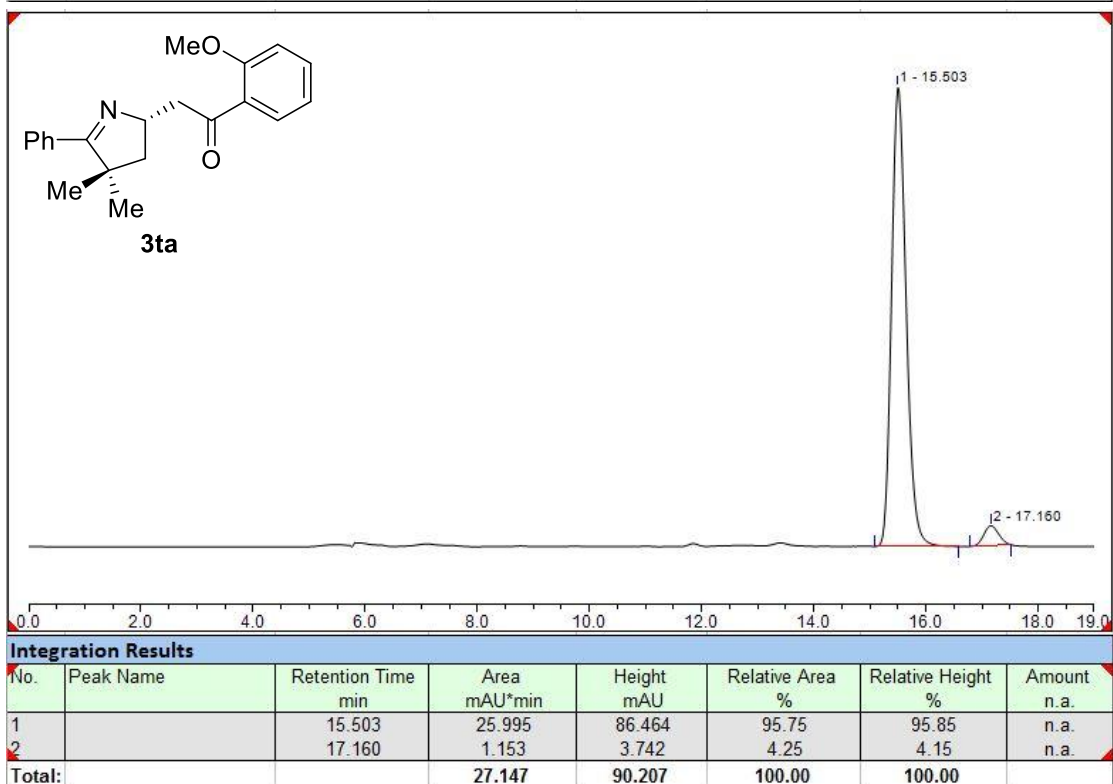
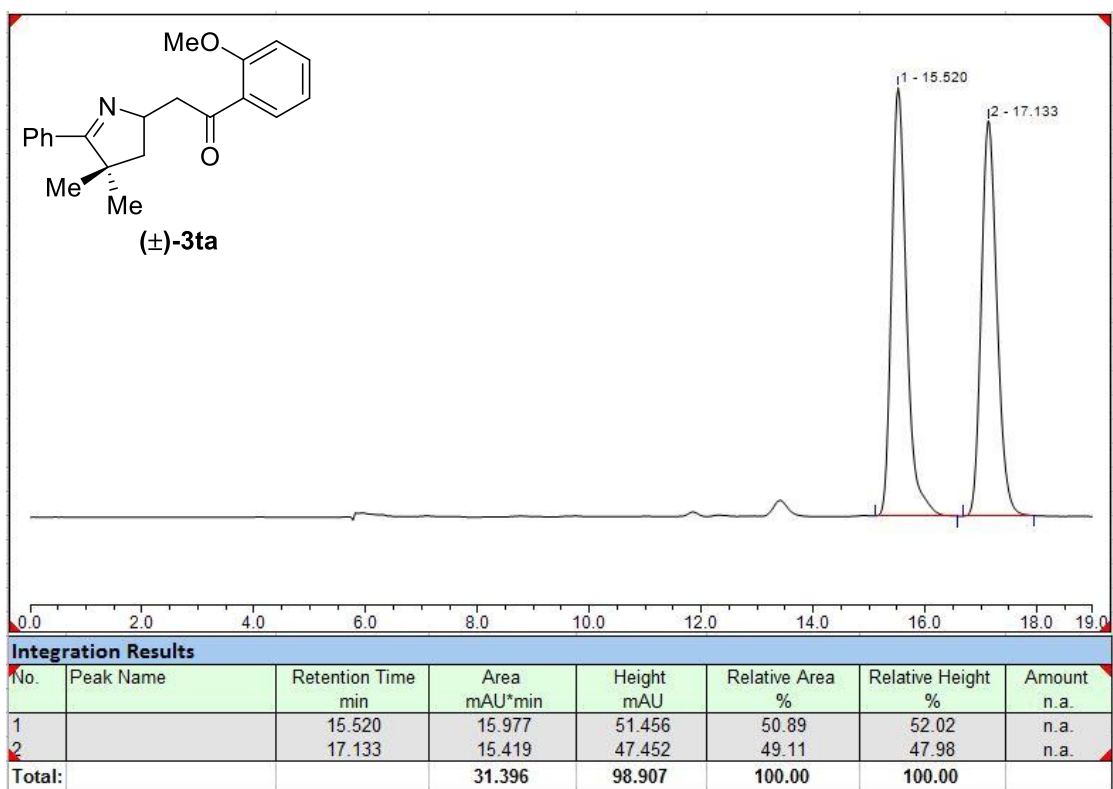
HPLC (Chiralpak IA): $t_R = 4.1$ (major), 4.7 (minor)

Condition: 70:30, *n*-Hexane:*i*-PrOH, flow rate 1.0 mL/min, 25 °C, 254 nm.



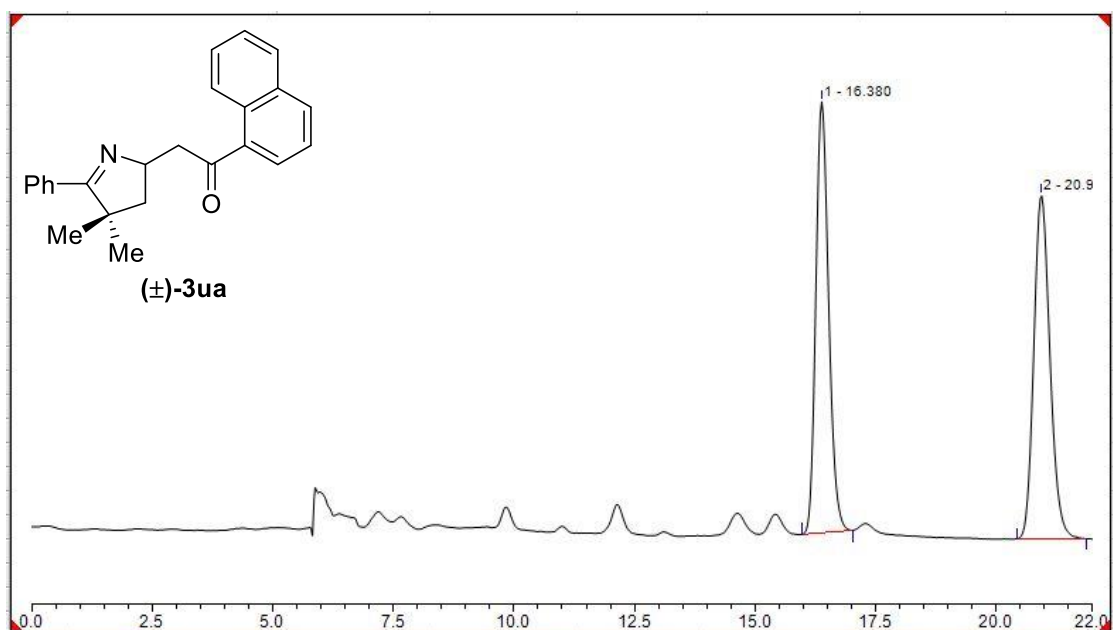
HPLC (Chiral MD): $t_R = 15.7$ (major), 18.0 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.

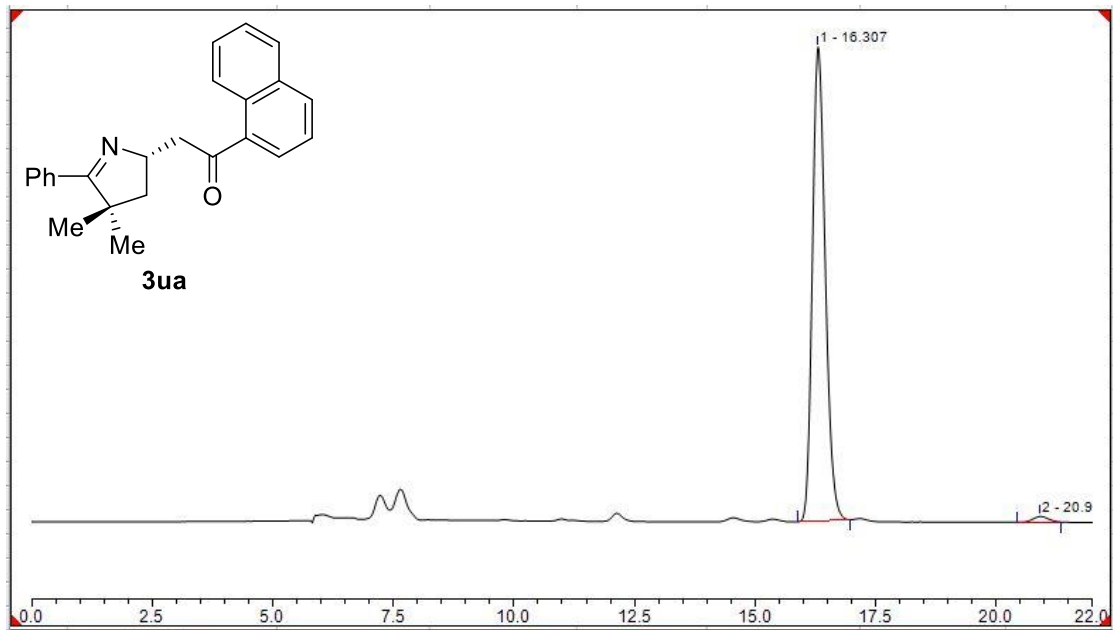


HPLC (Chiral MD): $t_R = 15.5$ (major), 17.2 (minor)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



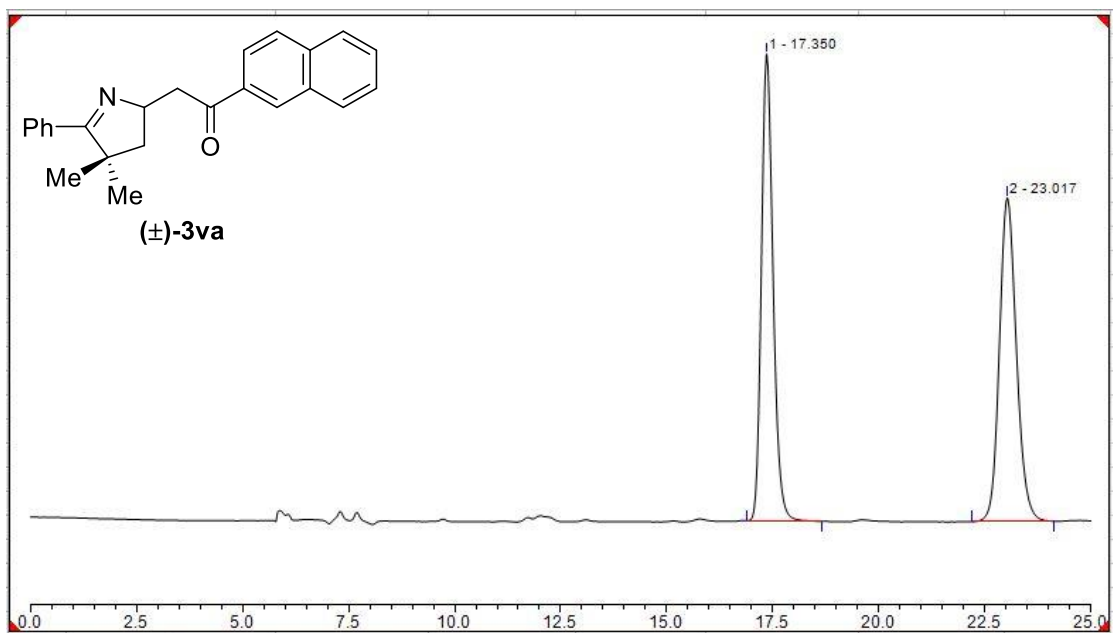
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		16.380	3.648	11.858	49.85	55.65	n.a.
2		20.933	3.671	9.450	50.15	44.35	n.a.
Total:			7.319	21.308	100.00	100.00	



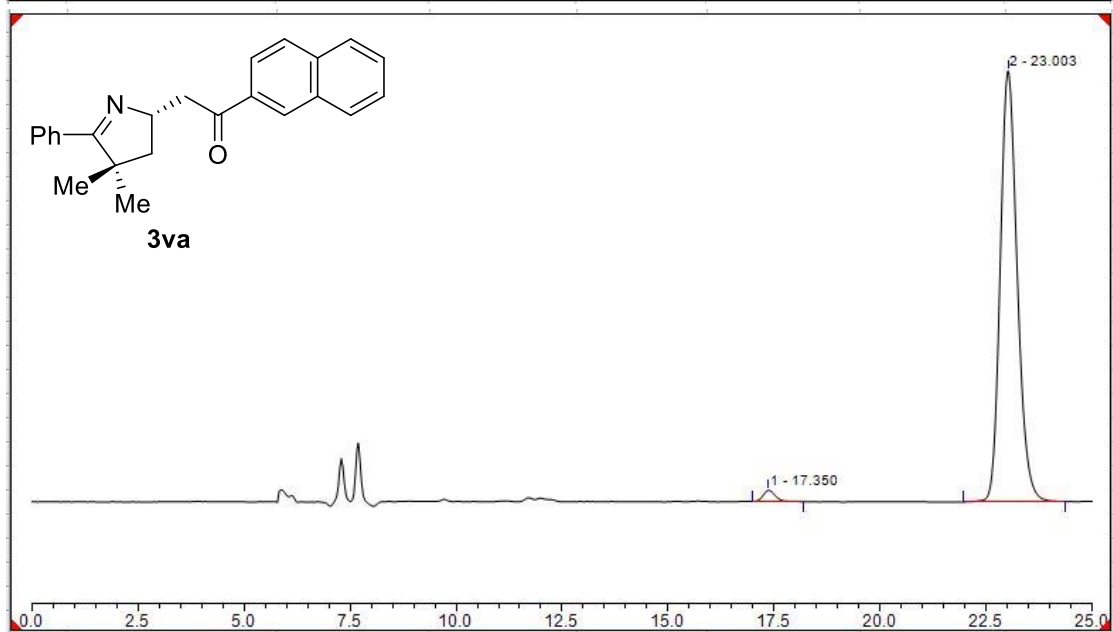
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		16.307	20.132	65.233	98.61	98.82	n.a.
2		20.907	0.285	0.777	1.39	1.18	n.a.
Total:			20.416	66.010	100.00	100.00	

HPLC (Chiral MD): $t_R = 16.3$ (major), 20.9 (minor)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



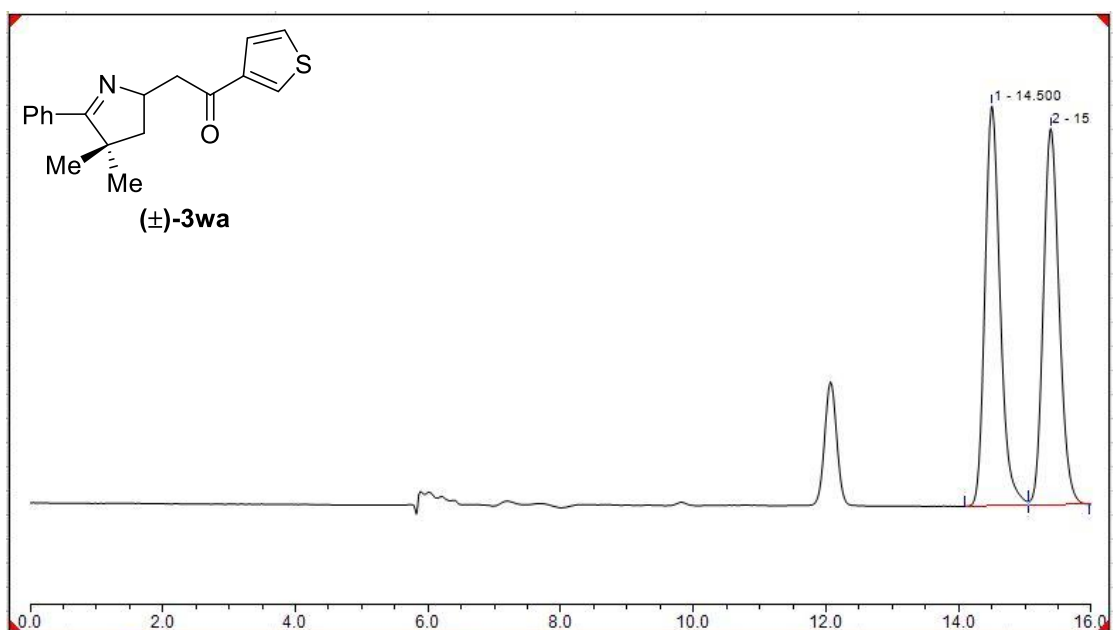
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		17.350	8.932	28.099	49.64	59.05	n.a.
2		23.017	9.061	19.487	50.36	40.95	n.a.
Total:			17.993	47.586	100.00	100.00	



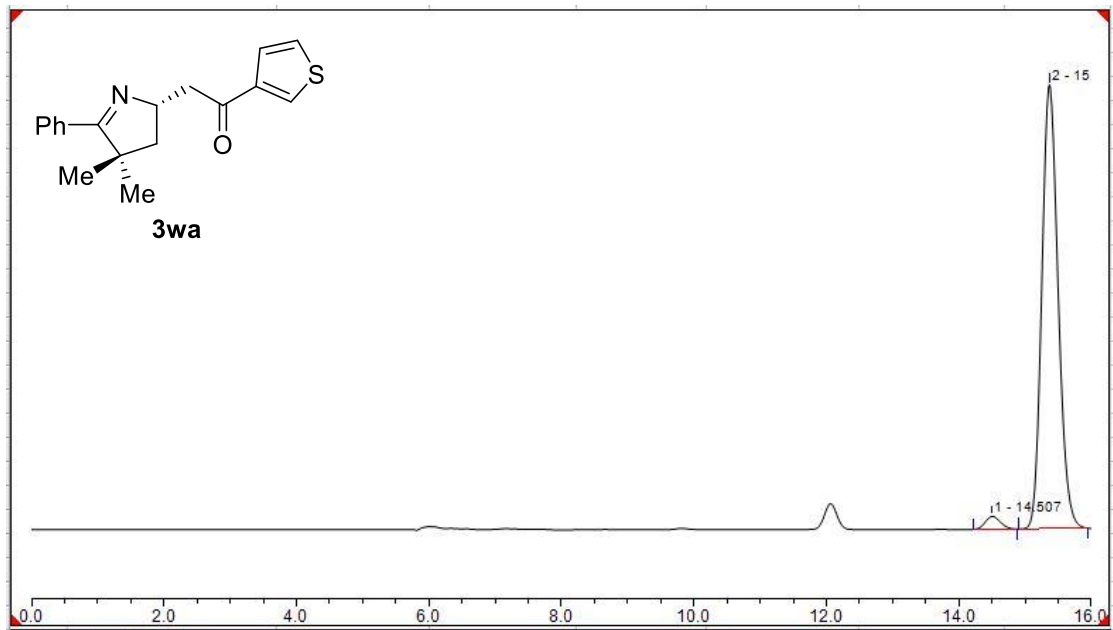
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		17.350	0.201	0.581	1.91	2.55	n.a.
2		23.003	10.326	22.223	98.09	97.45	n.a.
Total:			10.527	22.804	100.00	100.00	

HPLC (Chiral MD): $t_R = 17.4$ (major), 23.0 (minor)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



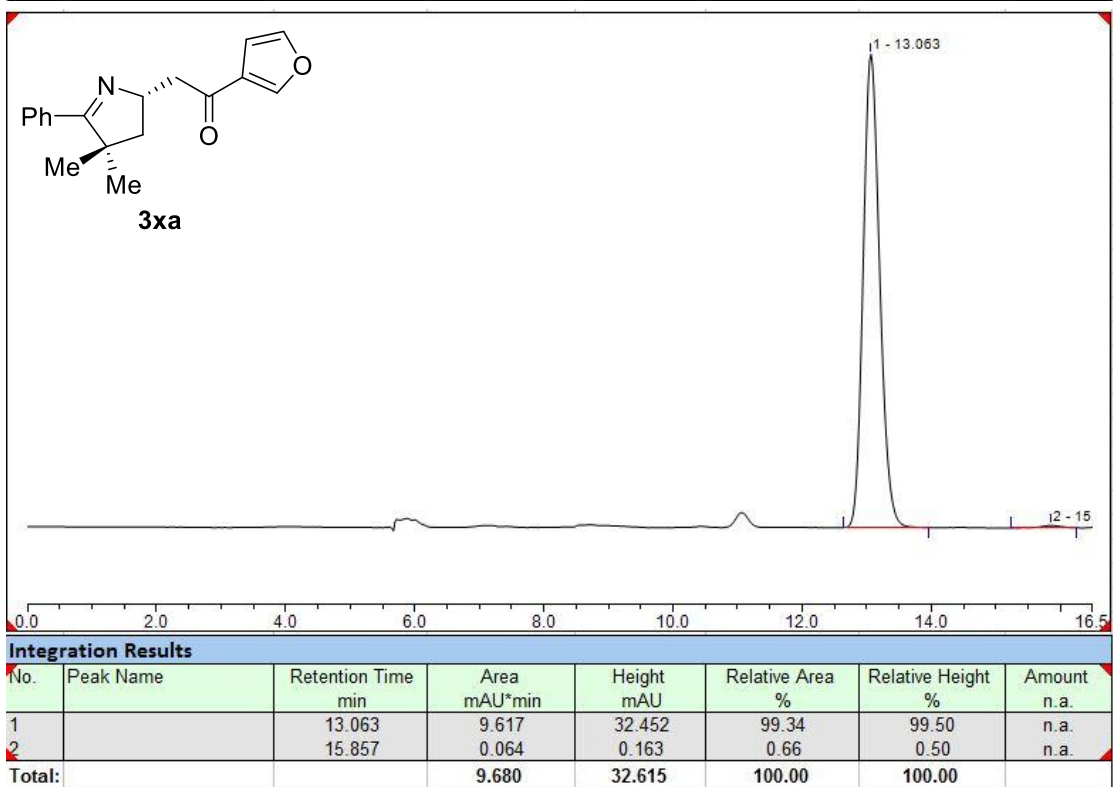
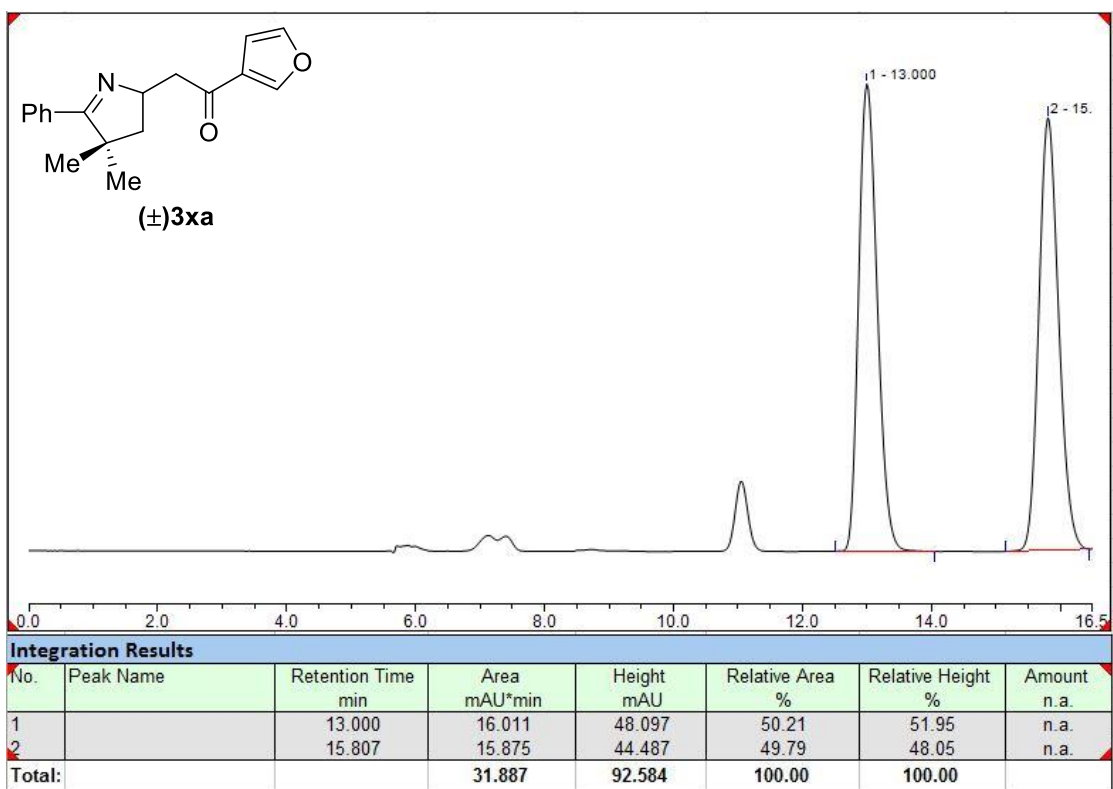
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.500	5.483	20.604	50.49	51.50	n.a.
2		15.387	5.377	19.401	49.51	48.50	n.a.
Total:			10.859	40.005	100.00	100.00	



Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.507	1.058	3.998	2.63	2.83	n.a.
2		15.367	39.111	137.475	97.37	97.17	n.a.
Total:			40.169	141.472	100.00	100.00	

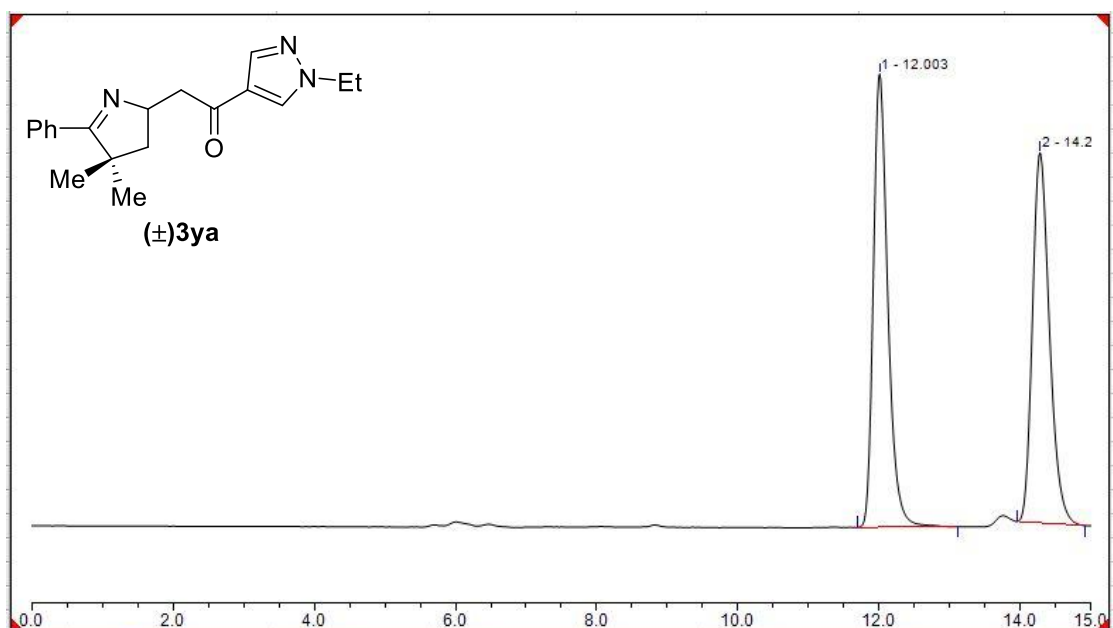
HPLC (Chiral MD): $t_R = 14.5$ (minor), 15.4 (major)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.

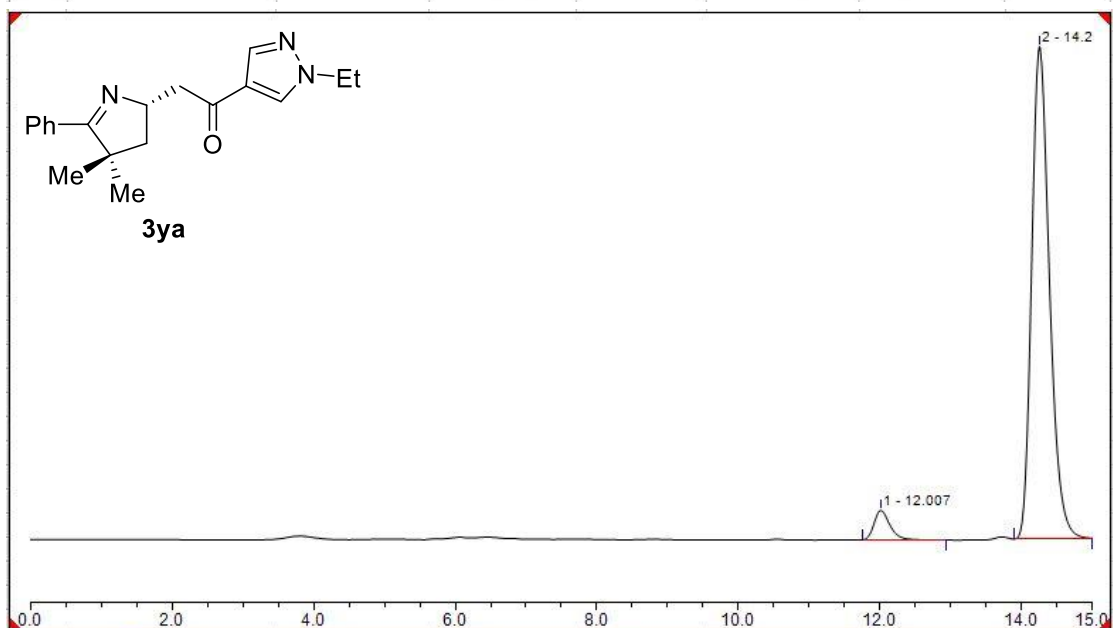


HPLC (Chiralpak AD-H): $t_R = 13.1$ (major), 15.9 (minor)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



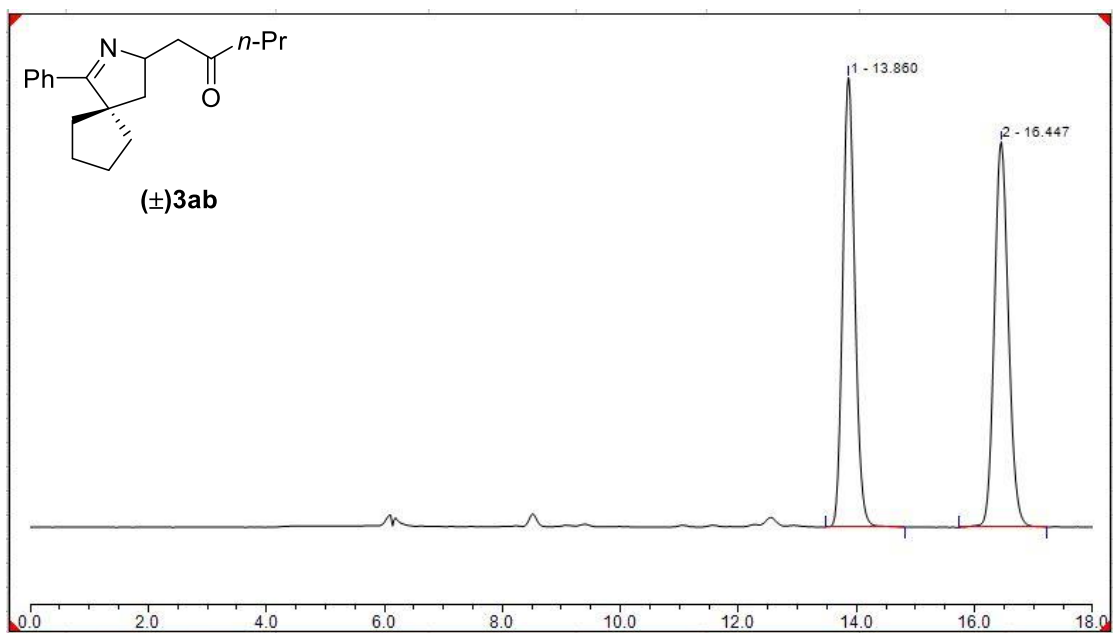
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		12.003	7.410	31.241	50.99	55.05	n.a.
2		14.270	7.121	25.508	49.01	44.95	n.a.
Total:			14.531	56.749	100.00	100.00	



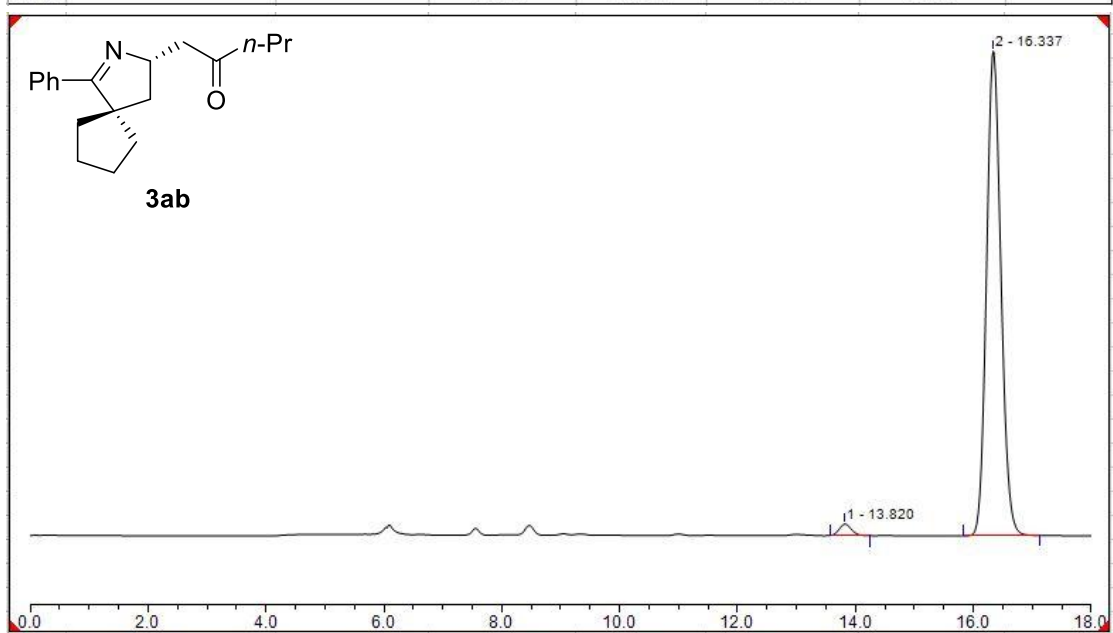
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		12.007	1.300	5.044	5.03	5.63	n.a.
2		14.247	24.564	84.554	94.97	94.37	n.a.
Total:			25.864	89.597	100.00	100.00	

HPLC (Chiral MD): $t_R = 12.0$ (minor), 14.2 (major)

Condition: 80:20, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



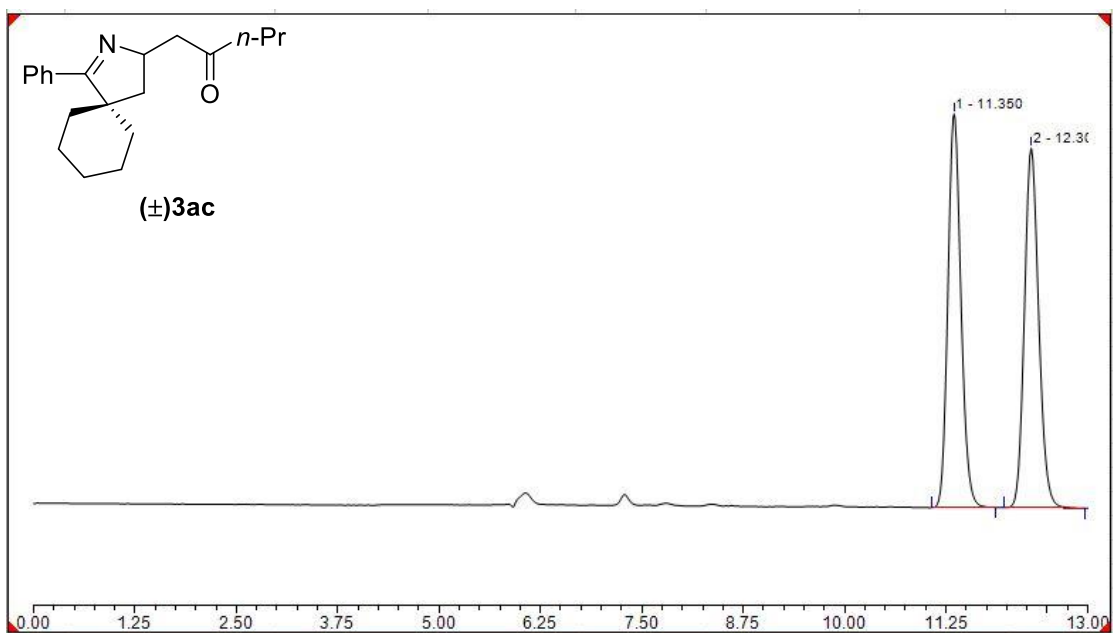
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		13.860	7.331	30.833	49.94	53.82	n.a.
2		16.447	7.348	26.451	50.06	46.18	n.a.
Total:			14.680	57.284	100.00	100.00	



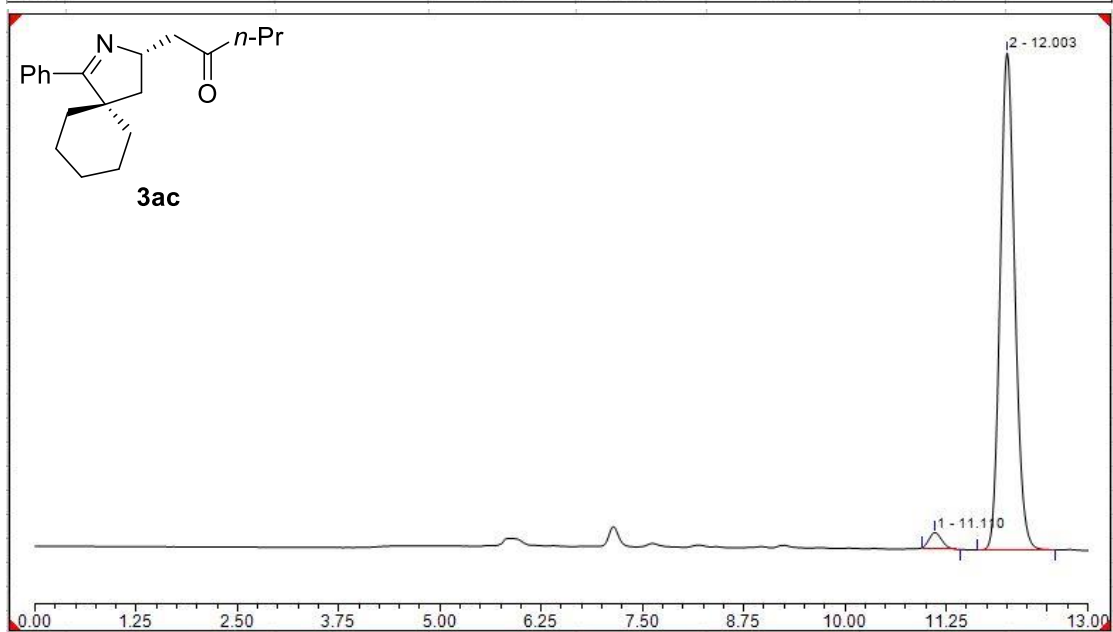
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		13.820	0.423	1.773	1.95	2.31	n.a.
2		16.337	21.238	75.008	98.05	97.69	n.a.
Total:			21.661	76.781	100.00	100.00	

HPLC (Chiral MD): $t_R = 13.8$ (minor), 16.3 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



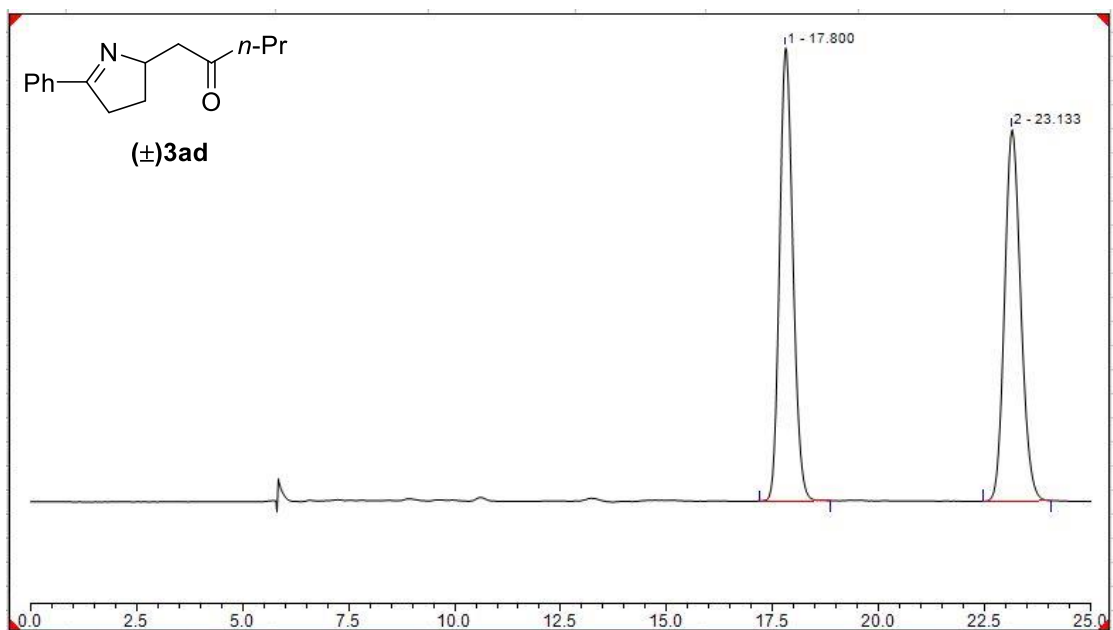
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.350	3.771	20.245	50.03	52.27	n.a.
2		12.300	3.767	18.483	49.97	47.73	n.a.
Total:			7.538	38.727	100.00	100.00	



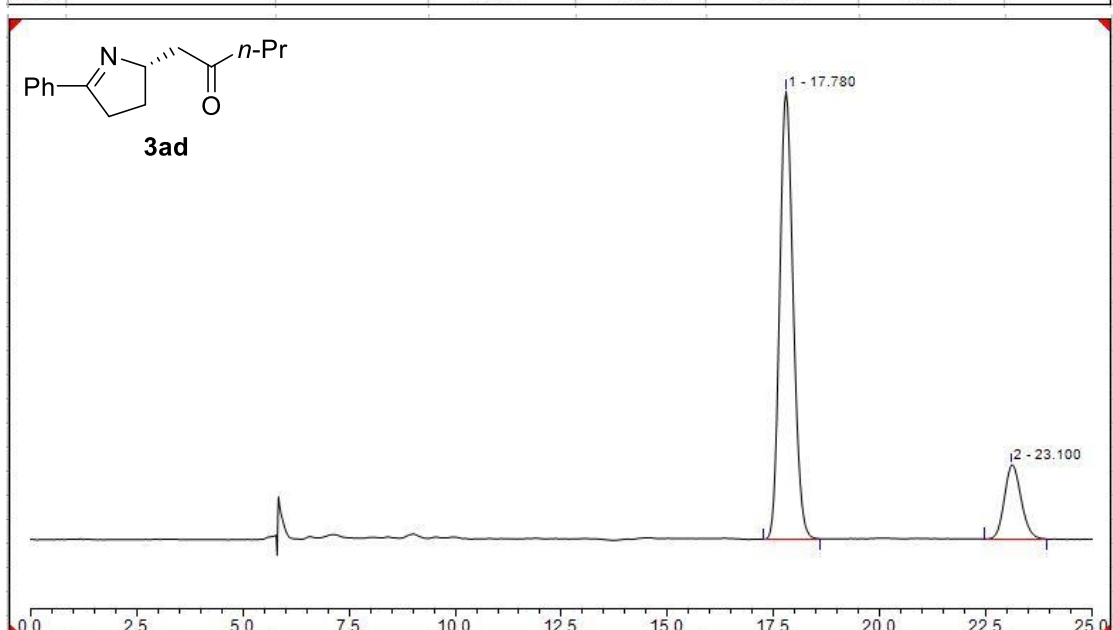
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.110	0.544	3.000	2.68	3.10	n.a.
2		12.003	19.737	93.879	97.32	96.90	n.a.
Total:			20.281	96.878	100.00	100.00	

HPLC (Chiral MD): $t_R = 11.1$ (minor), 12.0 (major)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



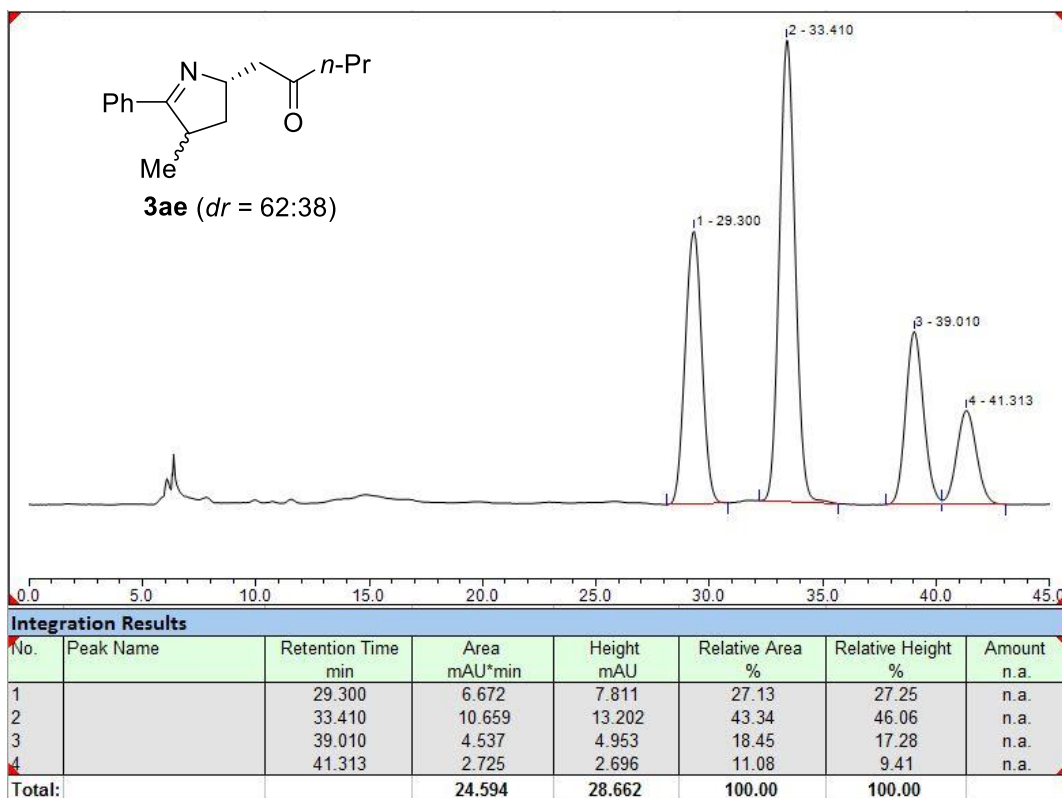
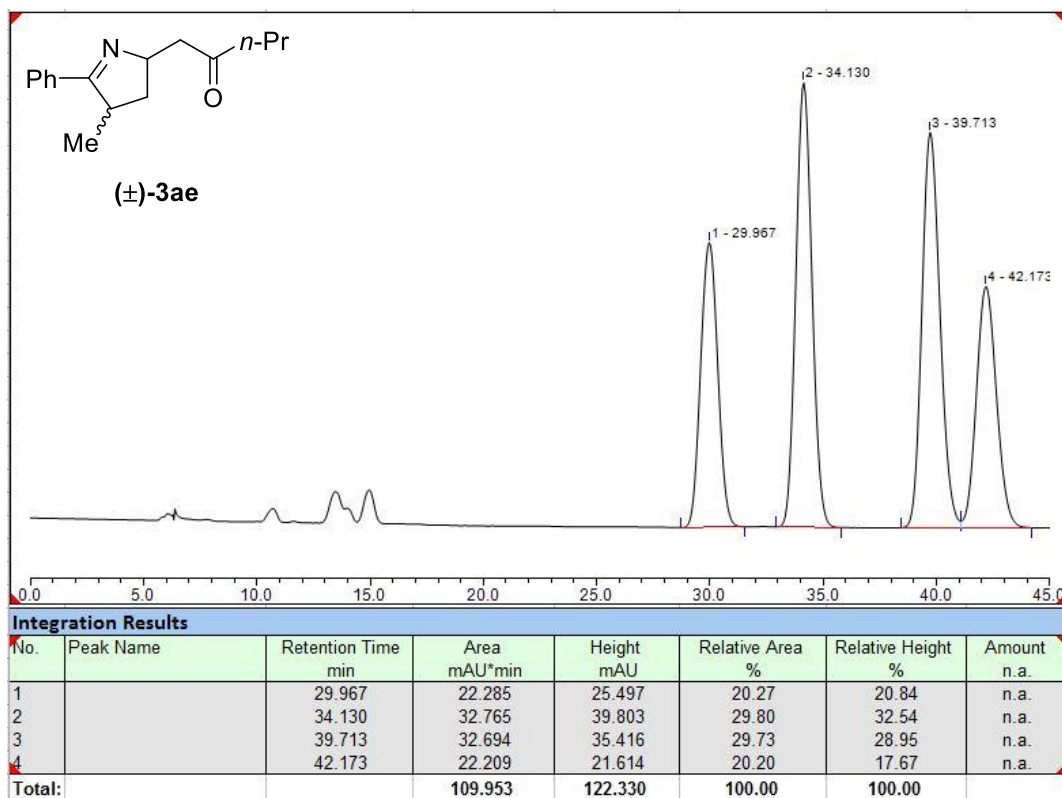
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		17.800	8.541	23.362	50.17	54.95	n.a.
2		23.133	8.484	19.156	49.83	45.05	n.a.
Total:			17.025	42.519	100.00	100.00	



Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		17.780	5.107	13.842	82.95	85.75	n.a.
2		23.100	1.050	2.300	17.05	14.25	n.a.
Total:			6.157	16.143	100.00	100.00	

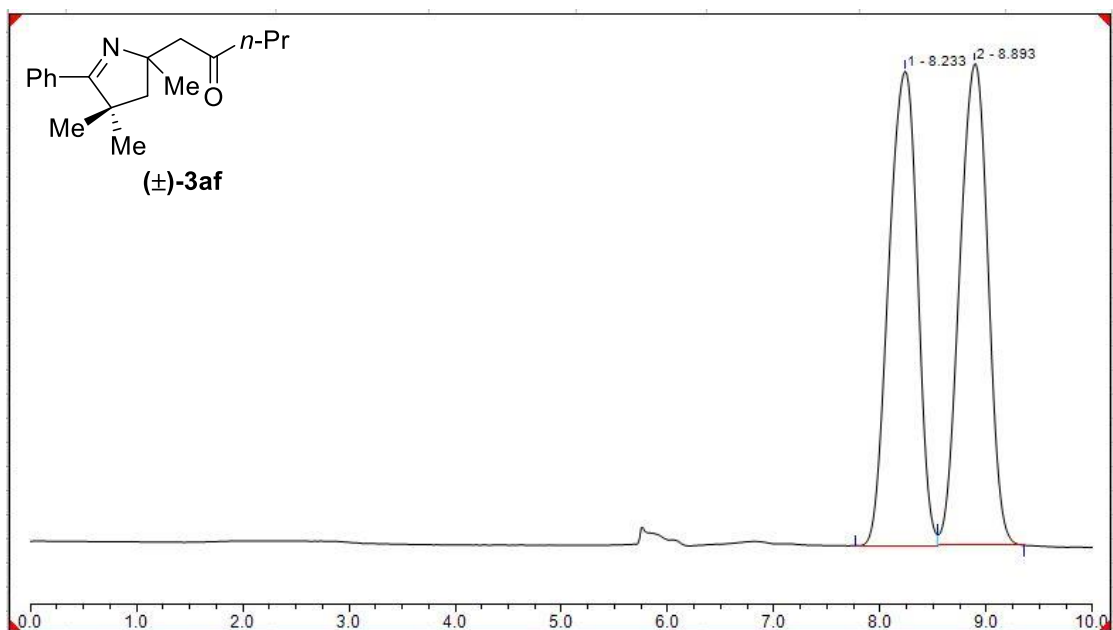
HPLC (Chiralpak AD-H): $t_R = 17.8$ (major), 23.1 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.

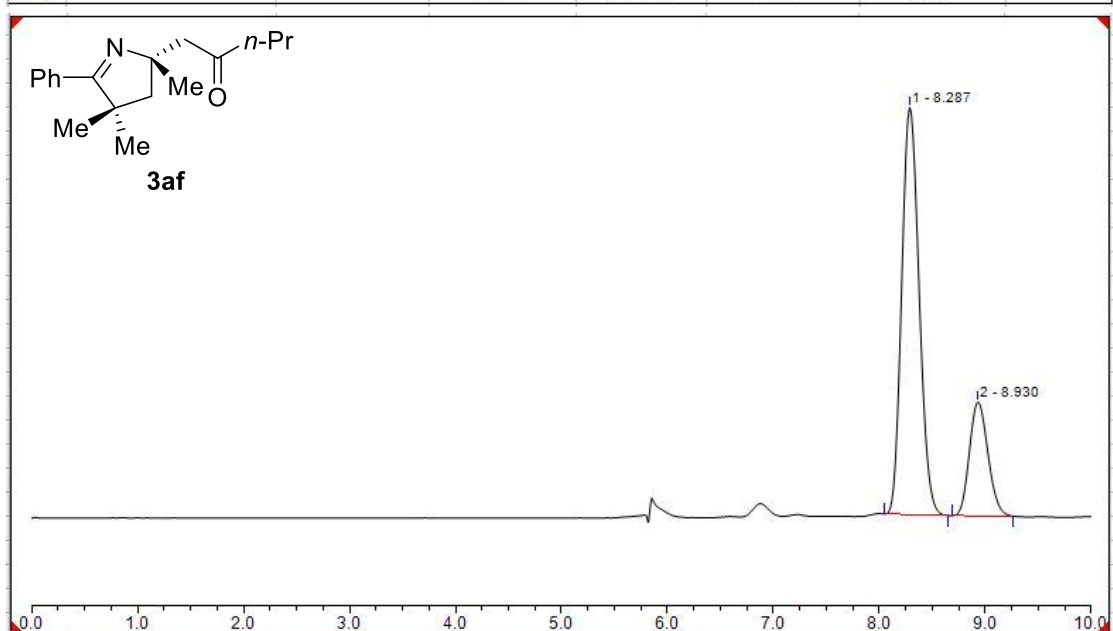


HPLC (Chiralpak AD-H): t_R = 29.3 (major, minor diastereomer), 33.4 (major, major diastereomer), 39.0 (minor, major diastereomer), 41.3 (minor, minor diastereomer)

Condition: 98:2, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



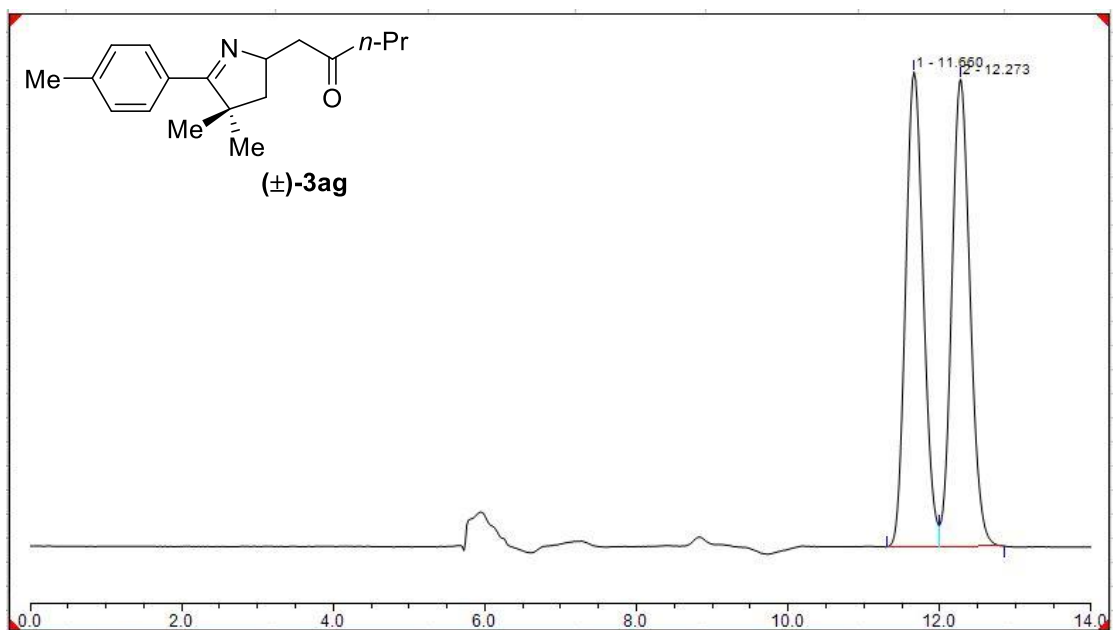
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.233	12.677	40.725	49.87	49.60	n.a.
2		8.893	12.742	41.384	50.13	50.40	n.a.
Total:			25.418	82.109	100.00	100.00	



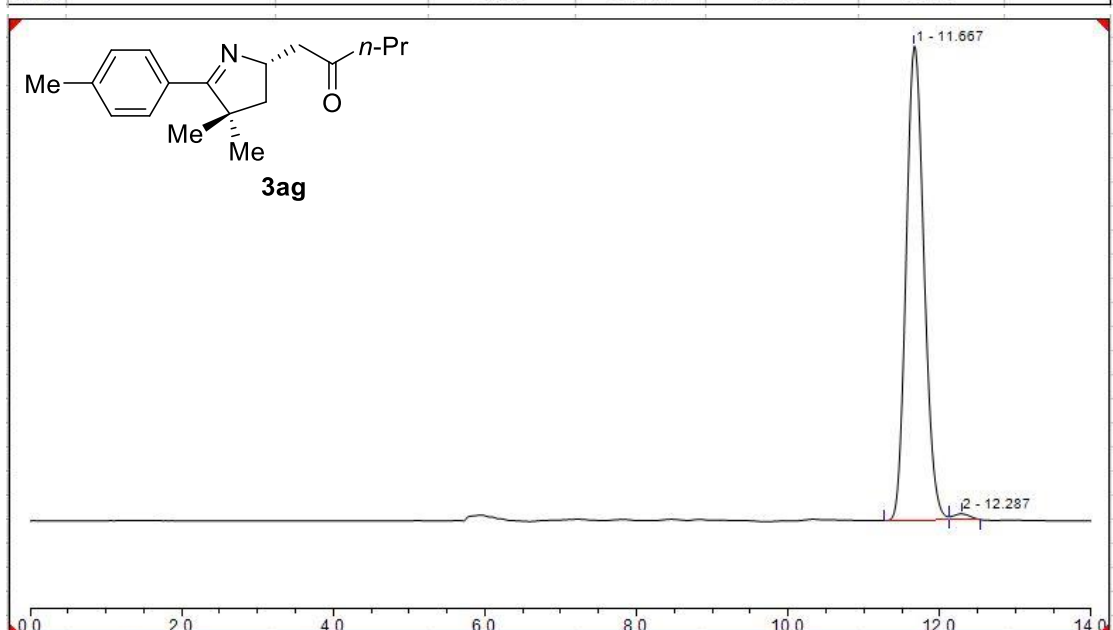
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.287	4.652	24.503	76.99	78.10	n.a.
2		8.930	1.390	6.870	23.01	21.90	n.a.
Total:			6.043	31.374	100.00	100.00	

HPLC (Chiralpak AD-H): $t_R = 8.3$ (major), 8.9 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



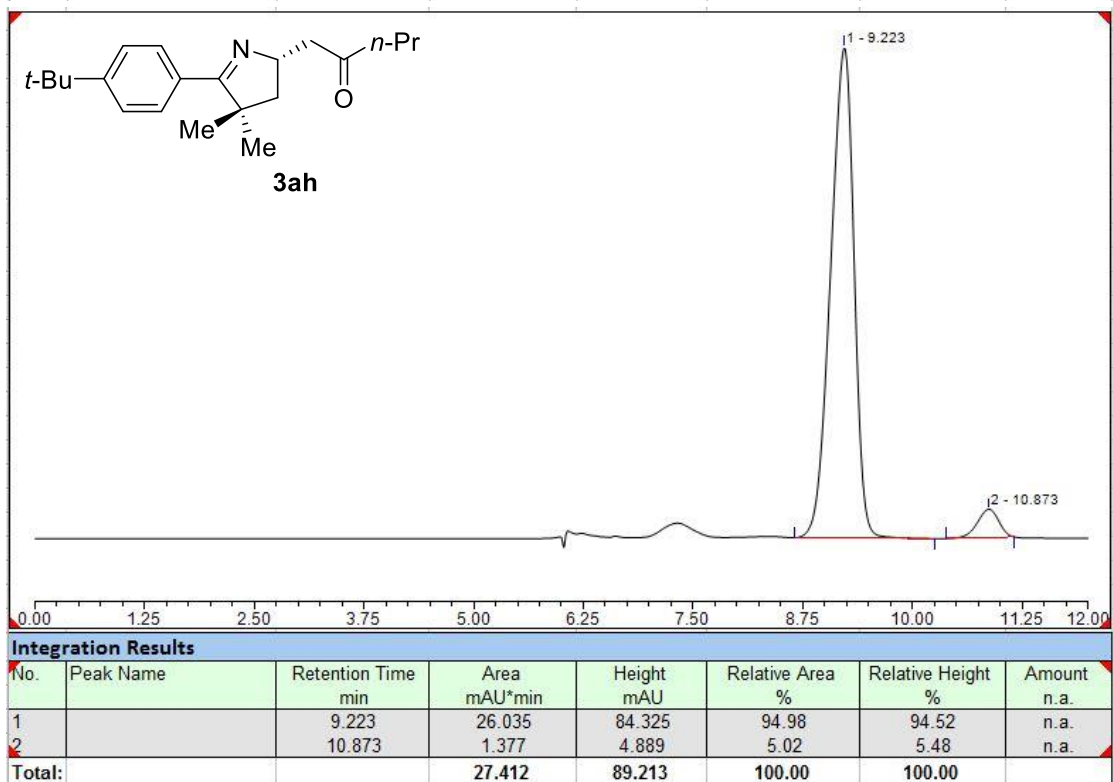
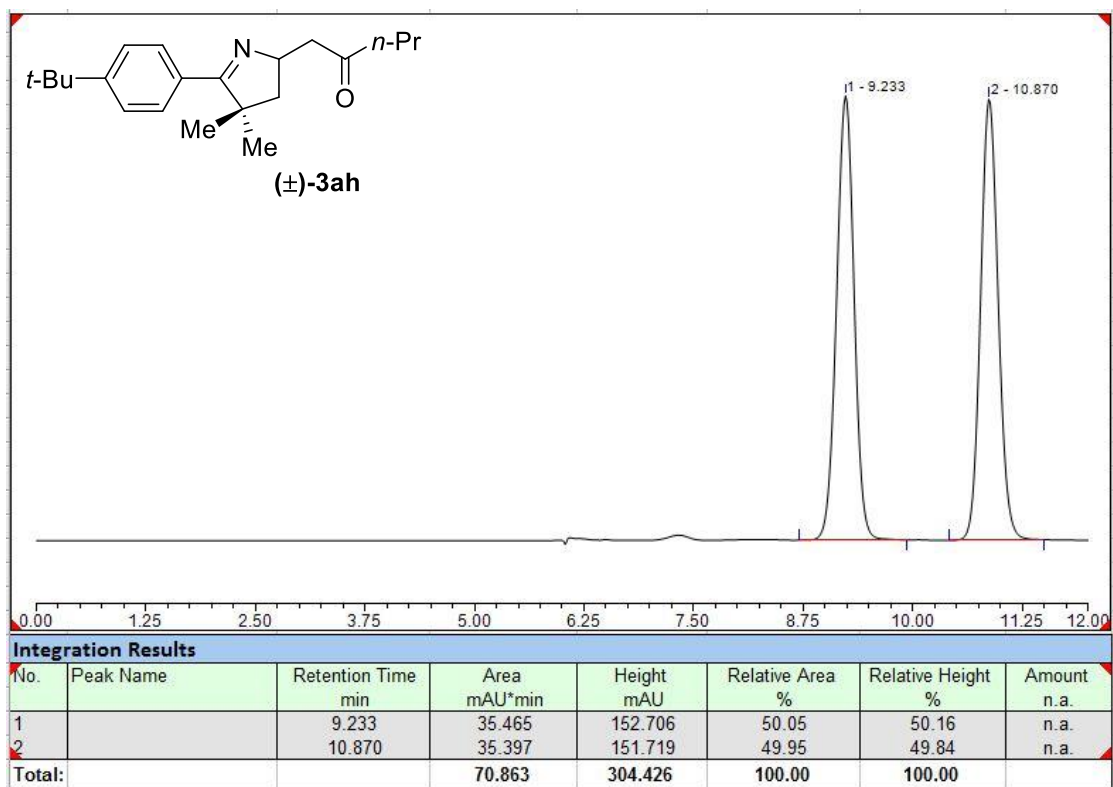
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.660	4.852	17.957	49.59	50.42	n.a.
2		12.273	4.932	17.657	50.41	49.58	n.a.
Total:			9.784	35.614	100.00	100.00	



Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.667	31.141	114.134	98.87	98.78	n.a.
2		12.287	0.356	1.407	1.13	1.22	n.a.
Total:			31.497	115.541	100.00	100.00	

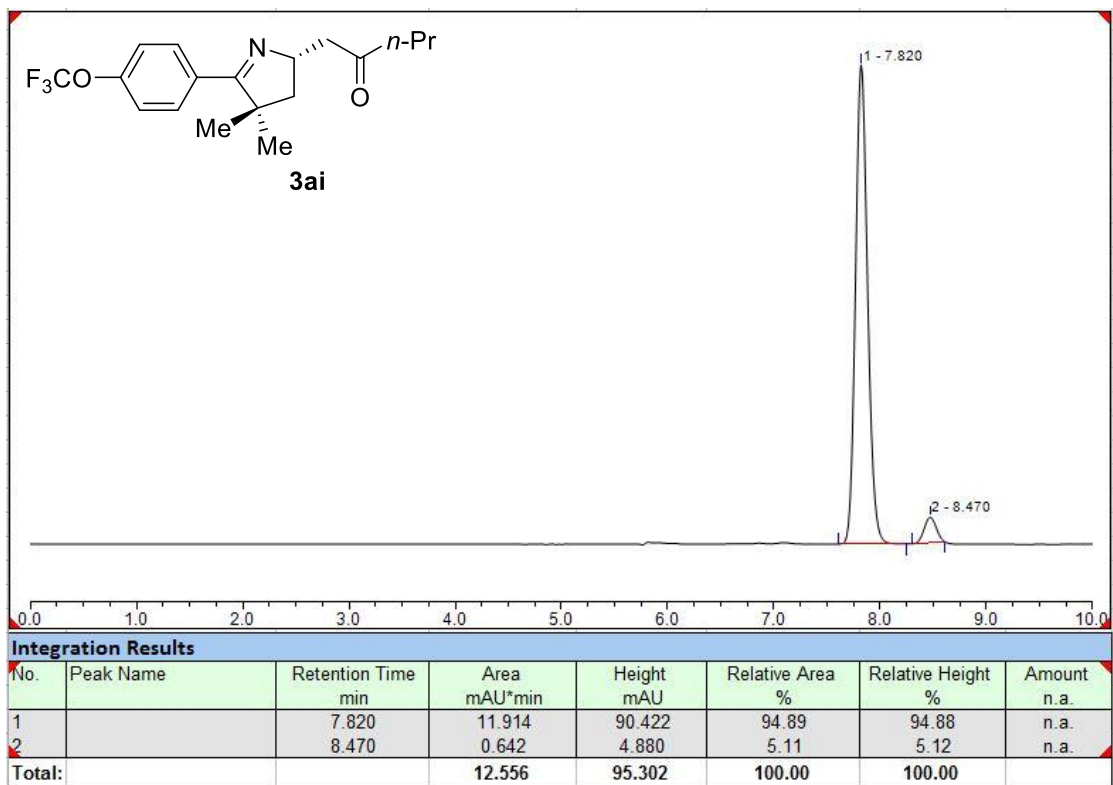
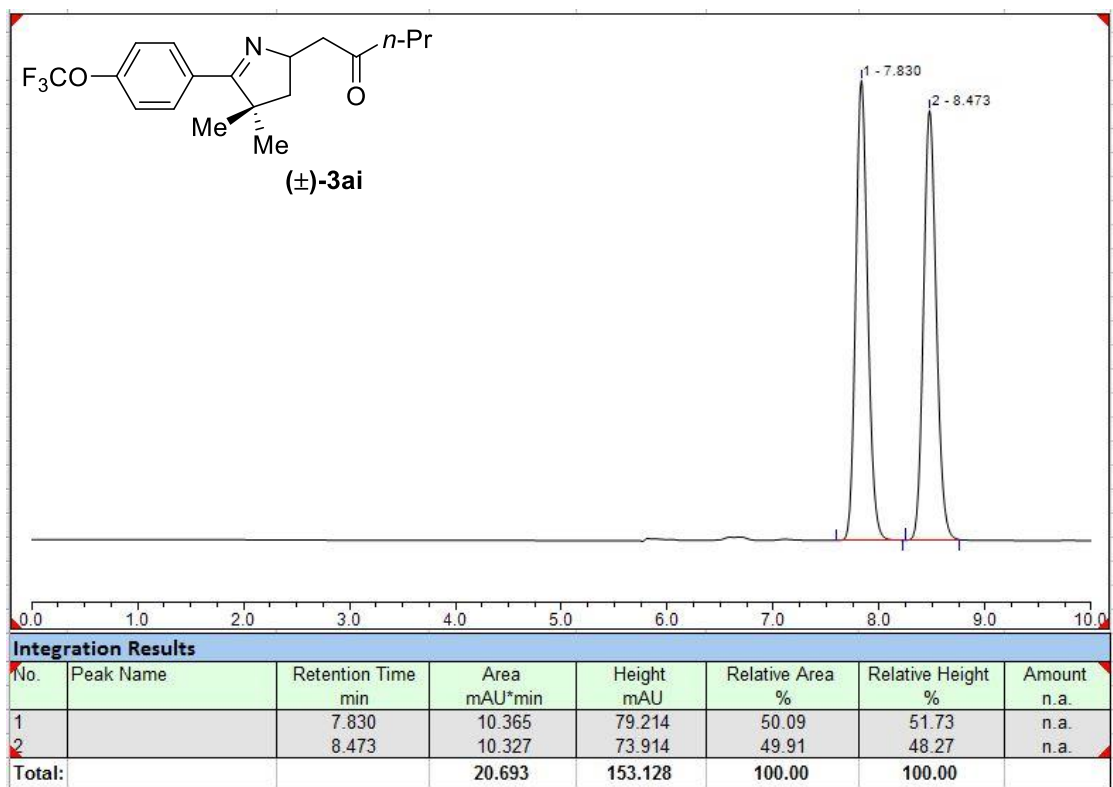
HPLC (Chiralpak AD-H): $t_R = 11.7$ (major), 12.3 (minor)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



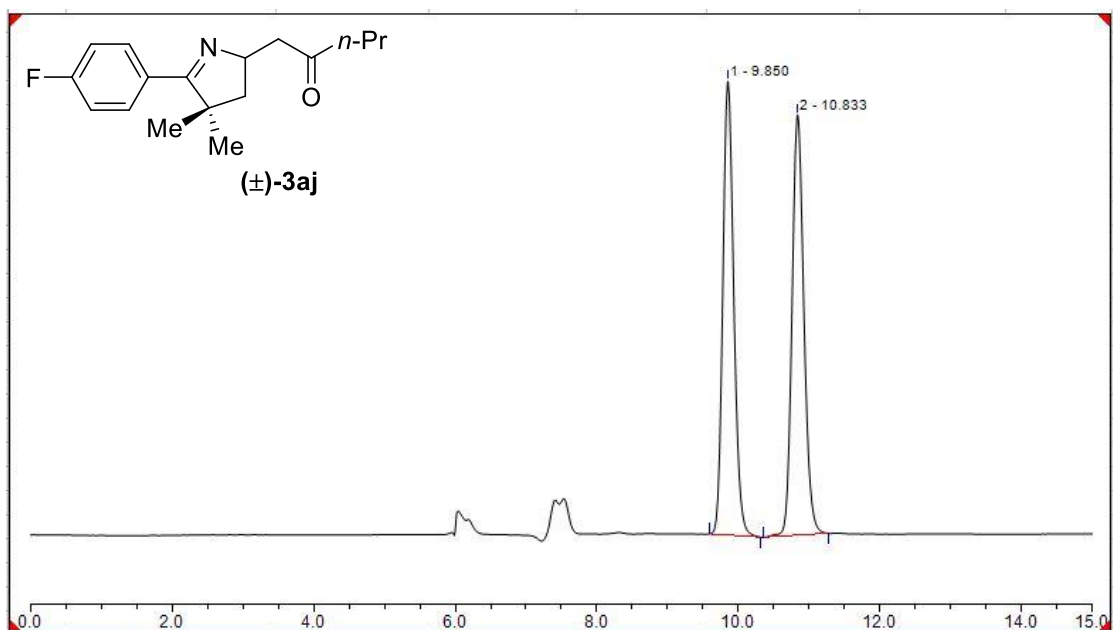
HPLC (Chiral MD): $t_R = 9.2$ (major), 10.9 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.

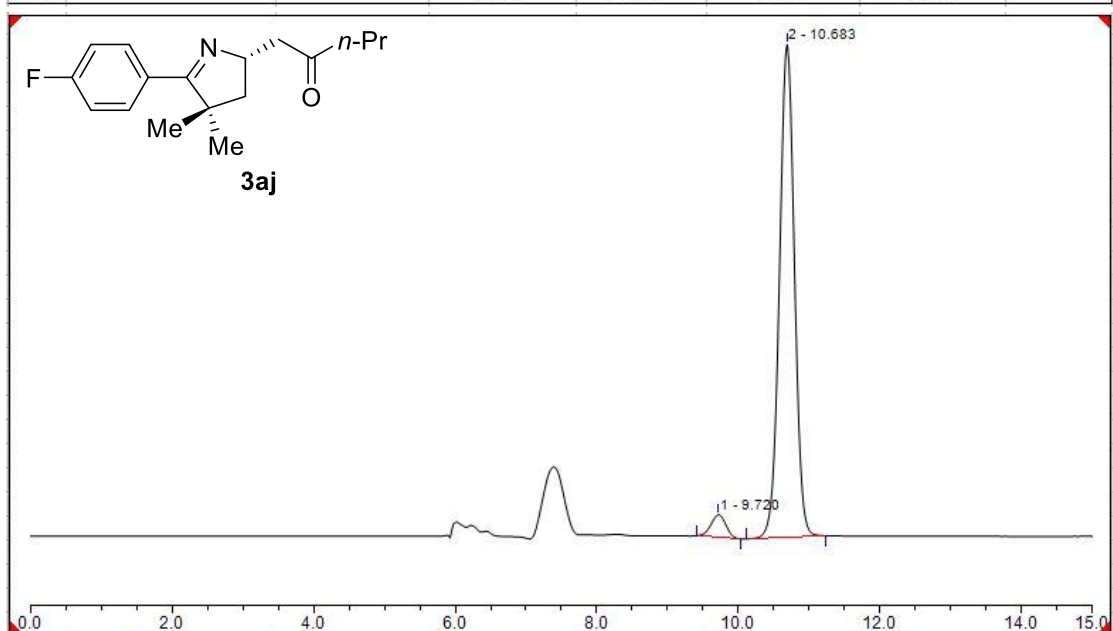


HPLC (Chiral MD): $t_R = 7.8$ (major), 8.5 (minor)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



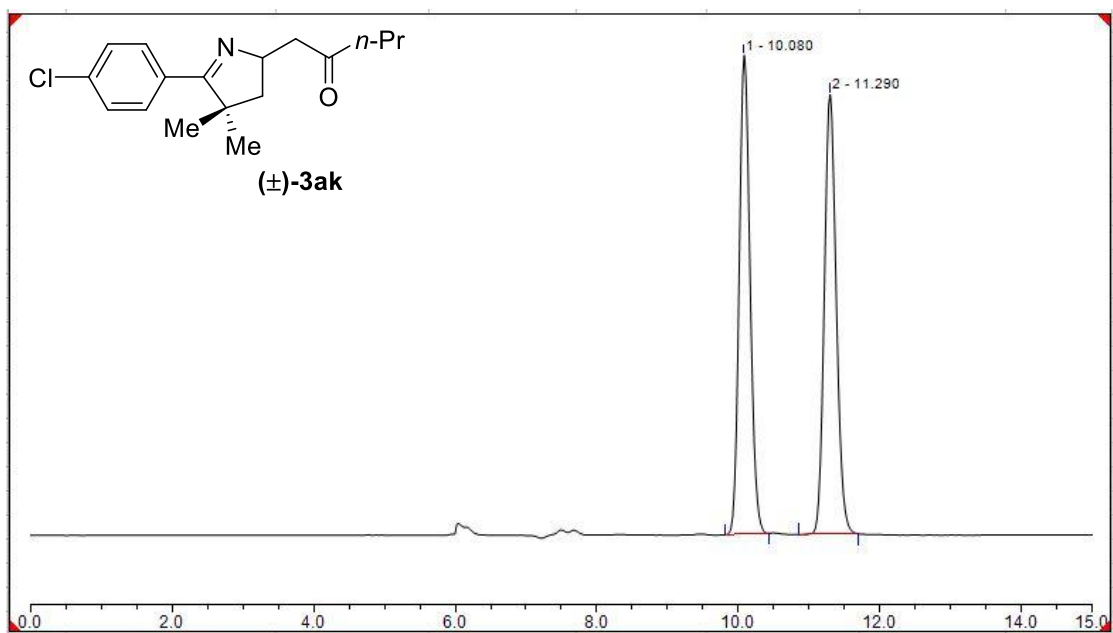
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		9.850	6.247	35.053	49.83	51.91	n.a.
2		10.833	6.291	32.474	50.17	48.09	n.a.
Total:			12.537	67.527	100.00	100.00	



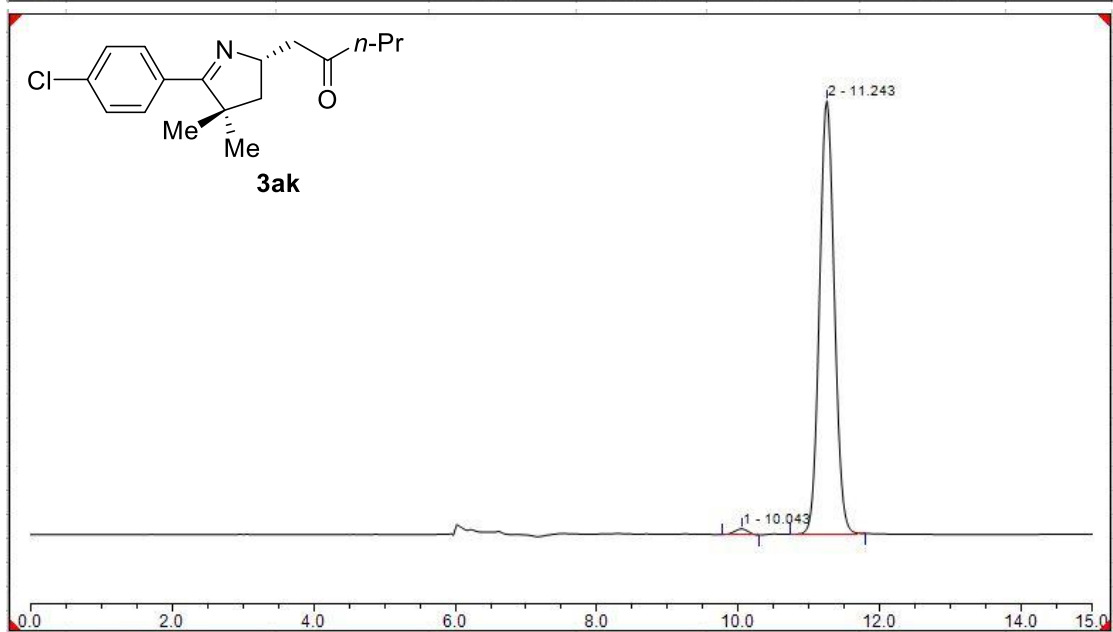
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		9.720	0.844	3.484	4.33	4.37	n.a.
2		10.683	18.639	76.175	95.67	95.63	n.a.
Total:			19.483	79.659	100.00	100.00	

HPLC (Chiral MD): $t_R = 9.7$ (minor), 10.7 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



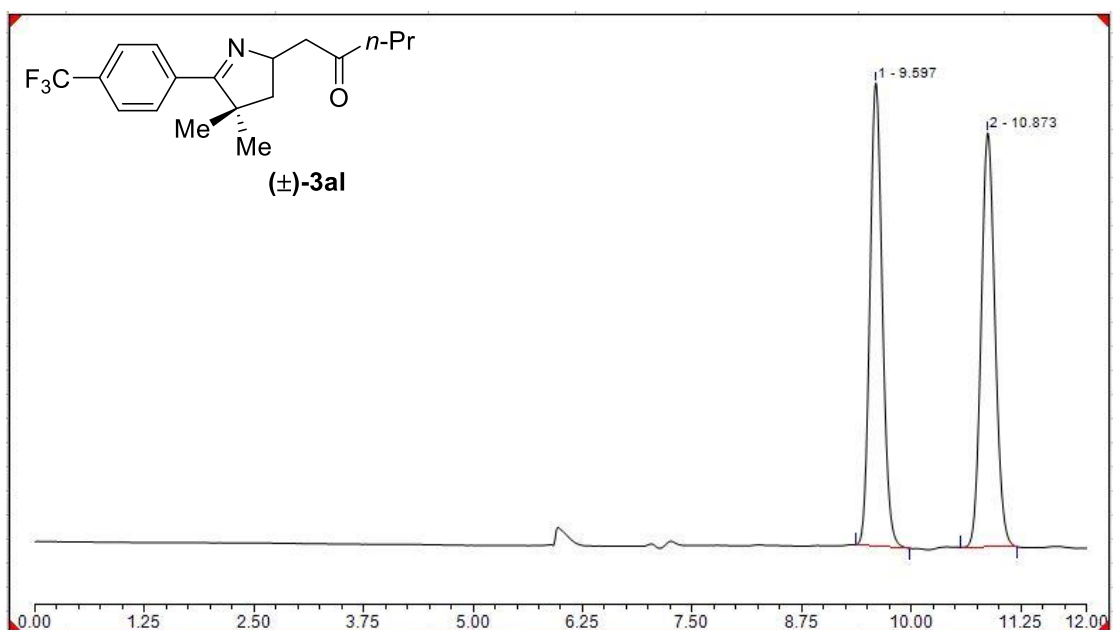
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.080	13.098	73.935	49.77	52.13	n.a.
2		11.290	13.216	67.894	50.23	47.87	n.a.
Total:			26.314	141.829	100.00	100.00	



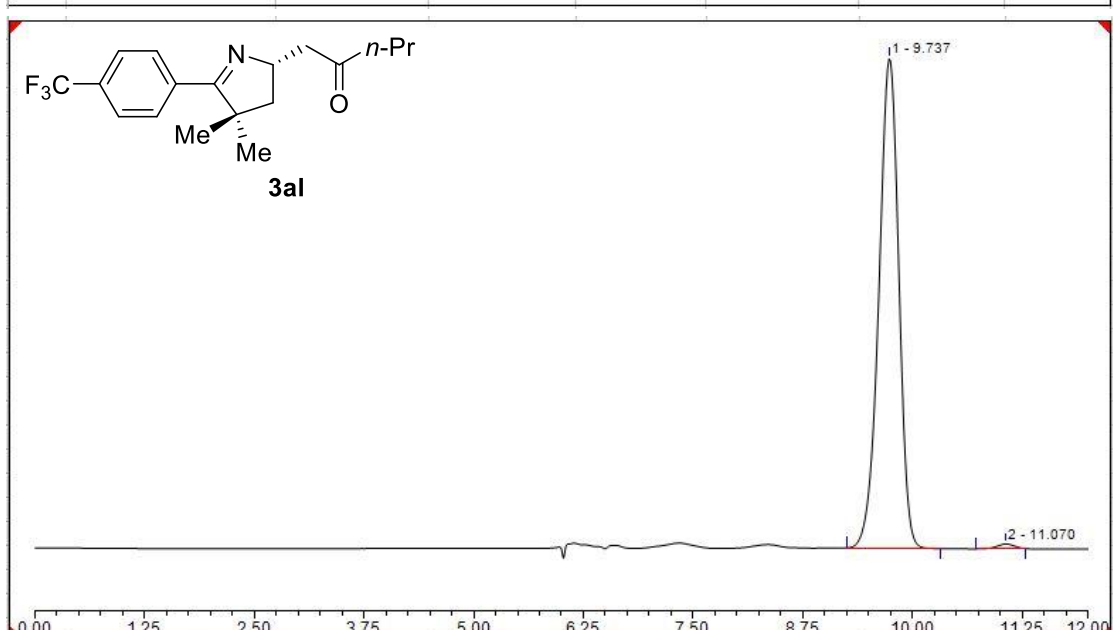
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.043	0.400	1.807	1.21	1.33	n.a.
2		11.243	32.582	134.007	98.79	98.67	n.a.
Total:			32.983	135.814	100.00	100.00	

HPLC (Chiral MD): $t_R = 10.0$ (minor), 11.2 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



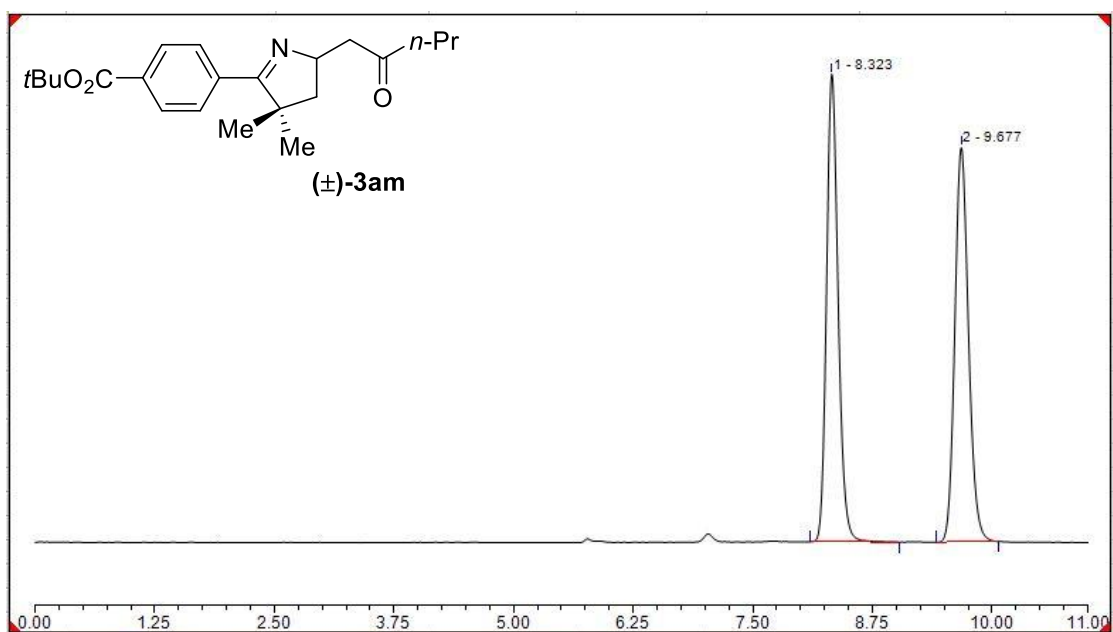
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		9.597	6.527	39.777	49.99	52.78	n.a.
2		10.873	6.529	35.580	50.01	47.22	n.a.
Total:			13.056	75.357	100.00	100.00	



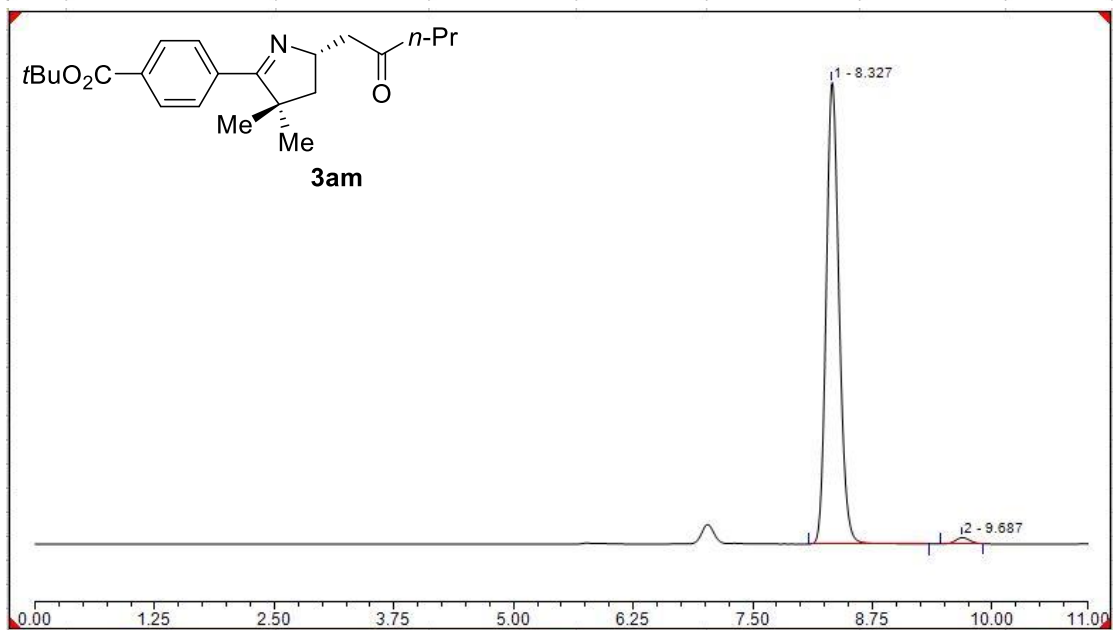
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		9.737	22.095	84.172	99.17	99.03	n.a.
2		11.070	0.186	0.821	0.83	0.97	n.a.
Total:			22.281	84.993	100.00	100.00	

HPLC (Chiral MD): $t_R = 9.7$ (major), 11.1 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



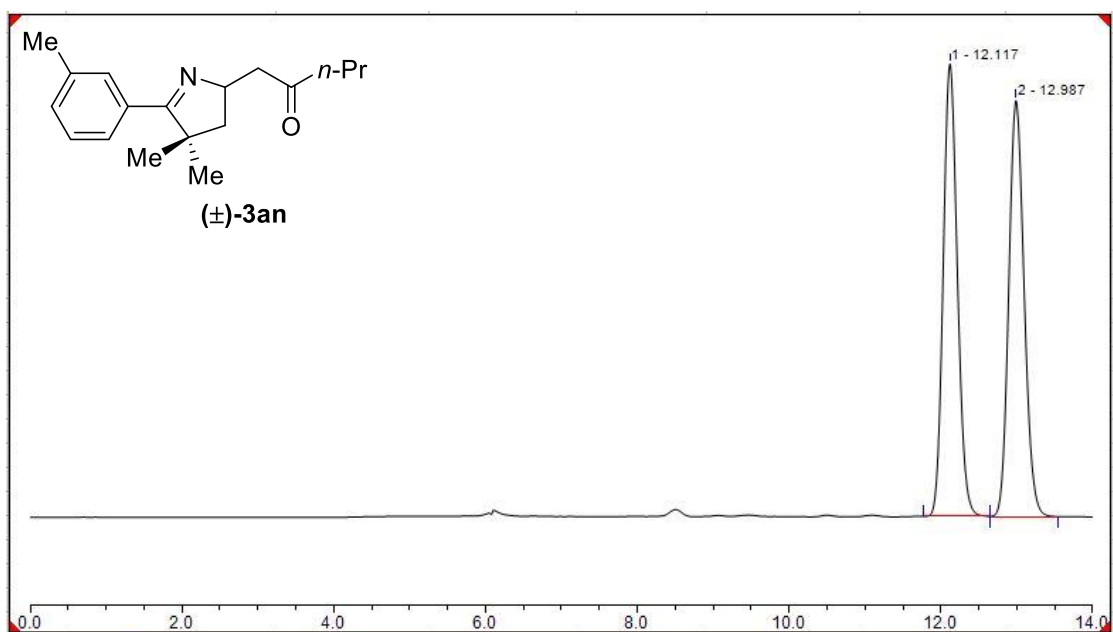
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.323	2.250	16.049	50.12	54.26	n.a.
2		9.677	2.239	13.530	49.88	45.74	n.a.
Total:			4.489	29.579	100.00	100.00	



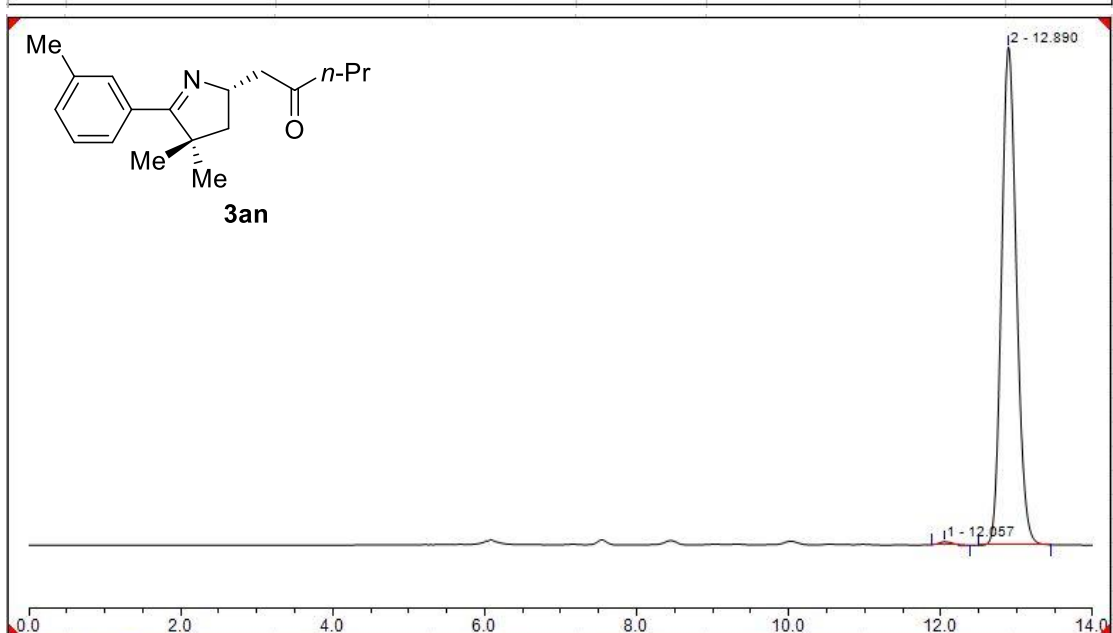
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.327	27.071	174.310	98.51	98.66	n.a.
2		9.687	0.408	2.371	1.49	1.34	n.a.
Total:			27.480	176.681	100.00	100.00	

HPLC (Chiral MD): $t_R = 8.3$ (major), 9.7 (minor)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



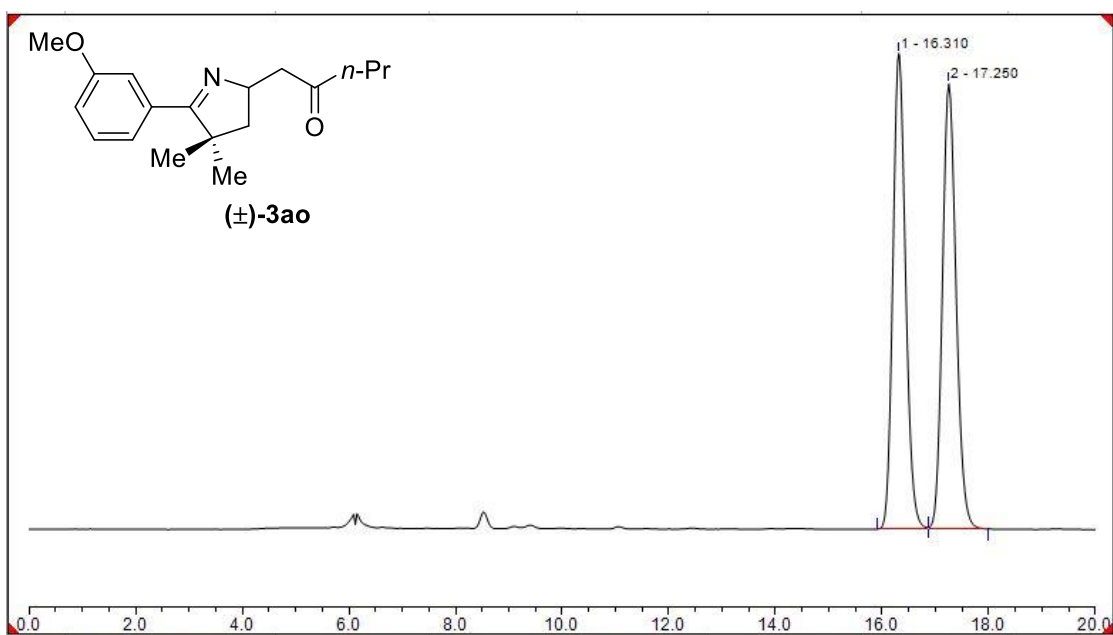
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		12.117	23.422	108.660	50.02	52.10	n.a.
2		12.987	23.403	99.907	49.98	47.90	n.a.
Total:			46.825	208.567	100.00	100.00	



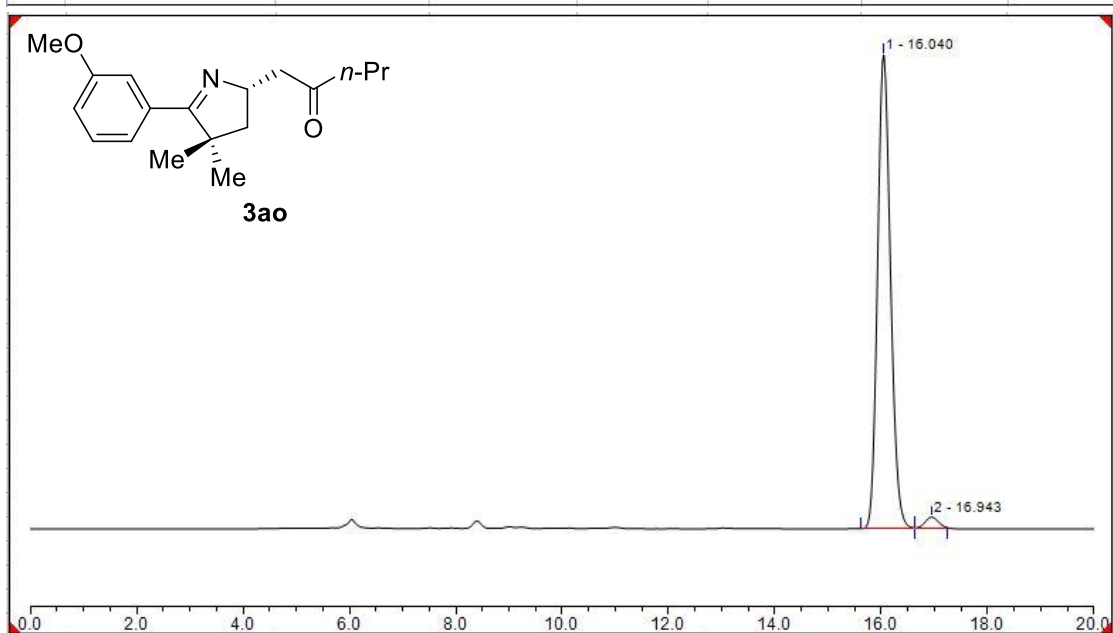
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		12.057	0.219	1.080	0.56	0.63	n.a.
2		12.890	38.926	170.844	99.44	99.37	n.a.
Total:			39.145	171.924	100.00	100.00	

HPLC (Chiral MD): $t_R = 12.1$ (minor), 12.9 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



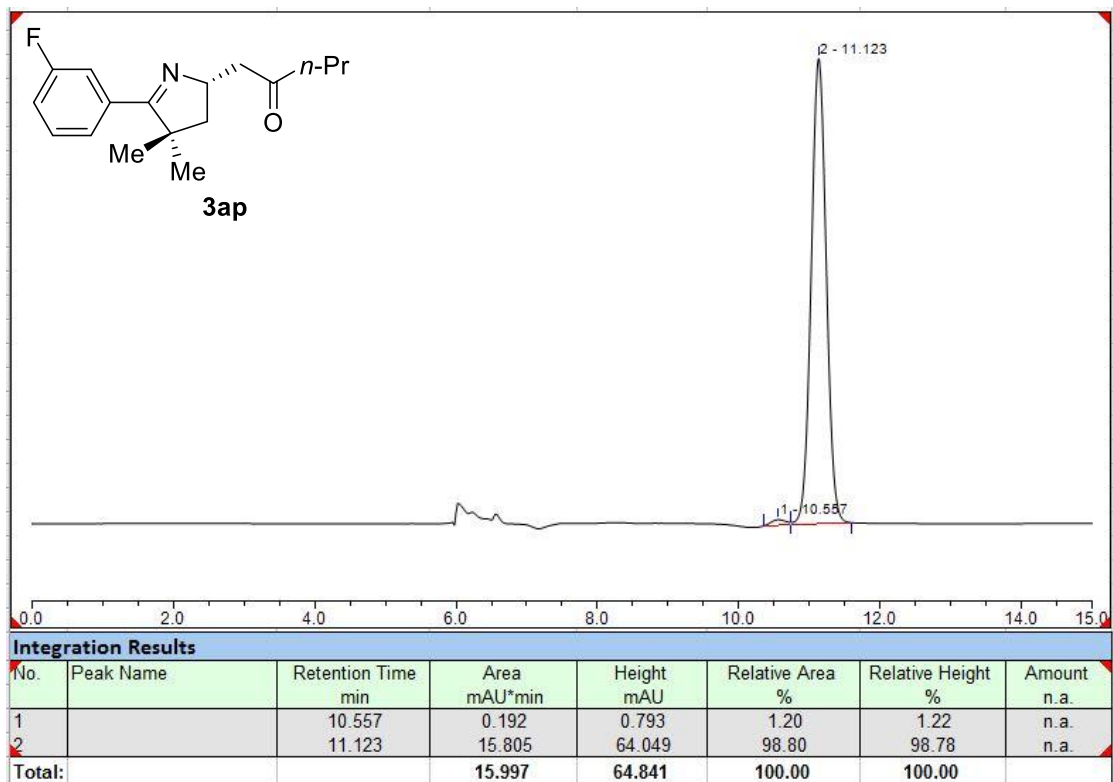
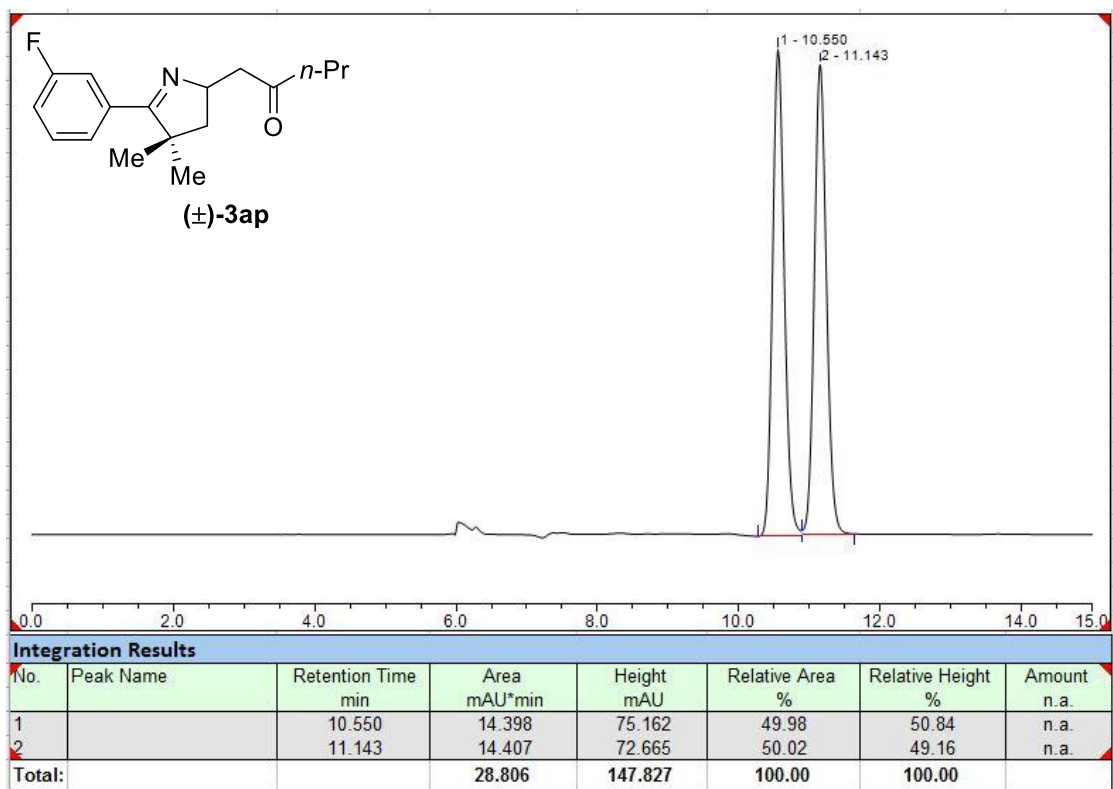
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		16.310	8.966	32.549	49.76	51.64	n.a.
2		17.250	9.053	30.480	50.24	48.36	n.a.
Total:			18.018	63.030	100.00	100.00	



Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		16.040	36.615	129.928	97.75	97.76	n.a.
2		16.943	0.841	2.983	2.25	2.24	n.a.
Total:			37.456	132.911	100.00	100.00	

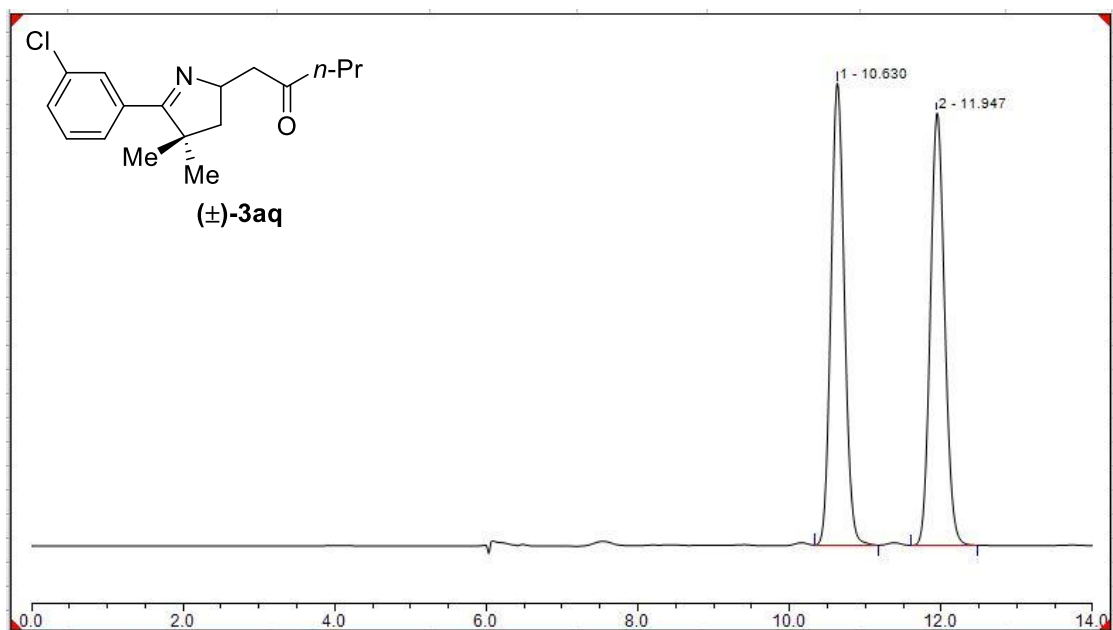
HPLC (Chiral MD): $t_R = 16.0$ (major), 16.9 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.

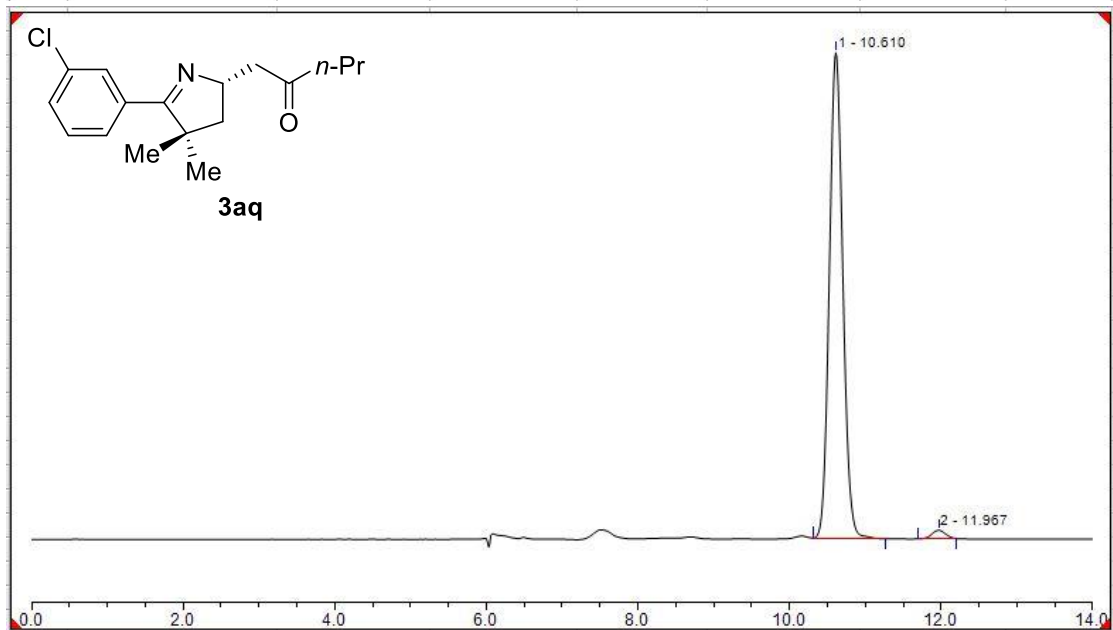


HPLC (Chiral MD): $t_R = 10.6$ (minor), 11.1 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



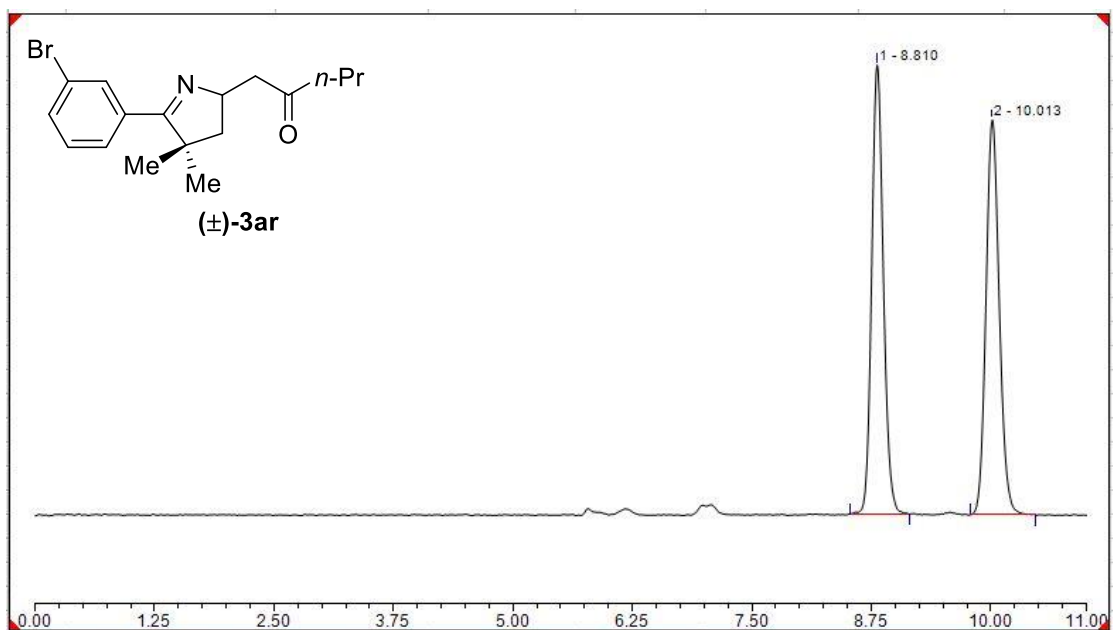
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.630	17.872	87.296	50.00	51.64	n.a.
2		11.947	17.870	81.758	50.00	48.36	n.a.
Total:			35.742	169.054	100.00	100.00	



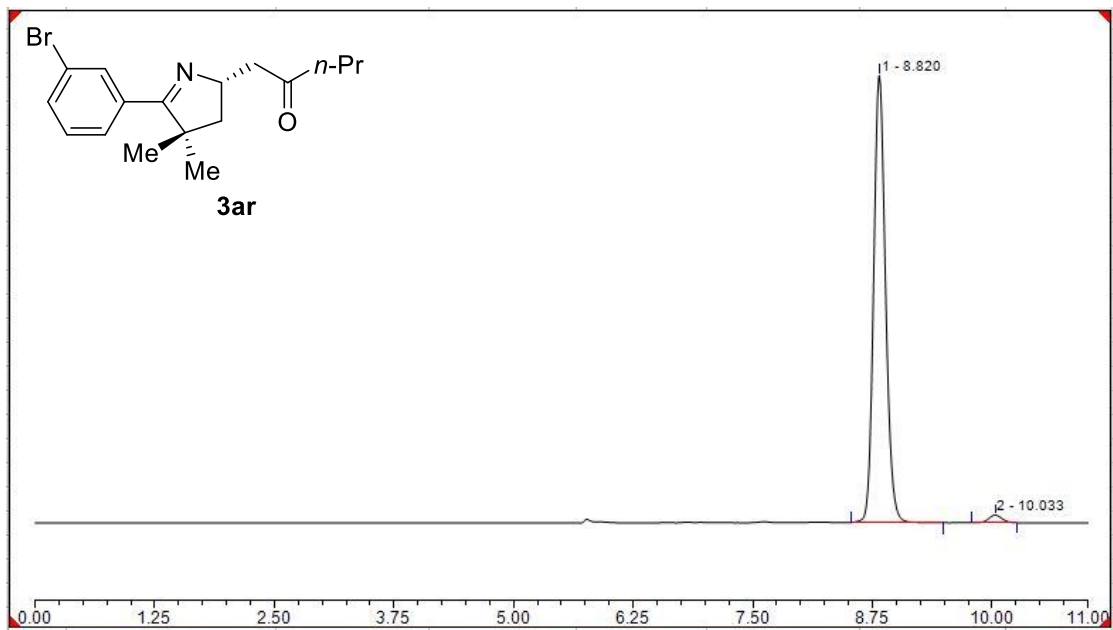
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.610	17.120	83.386	98.25	98.28	n.a.
2		11.967	0.305	1.456	1.75	1.72	n.a.
Total:			17.425	84.842	100.00	100.00	

HPLC (Chiral MD): $t_R = 10.6$ (major), 12.0 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



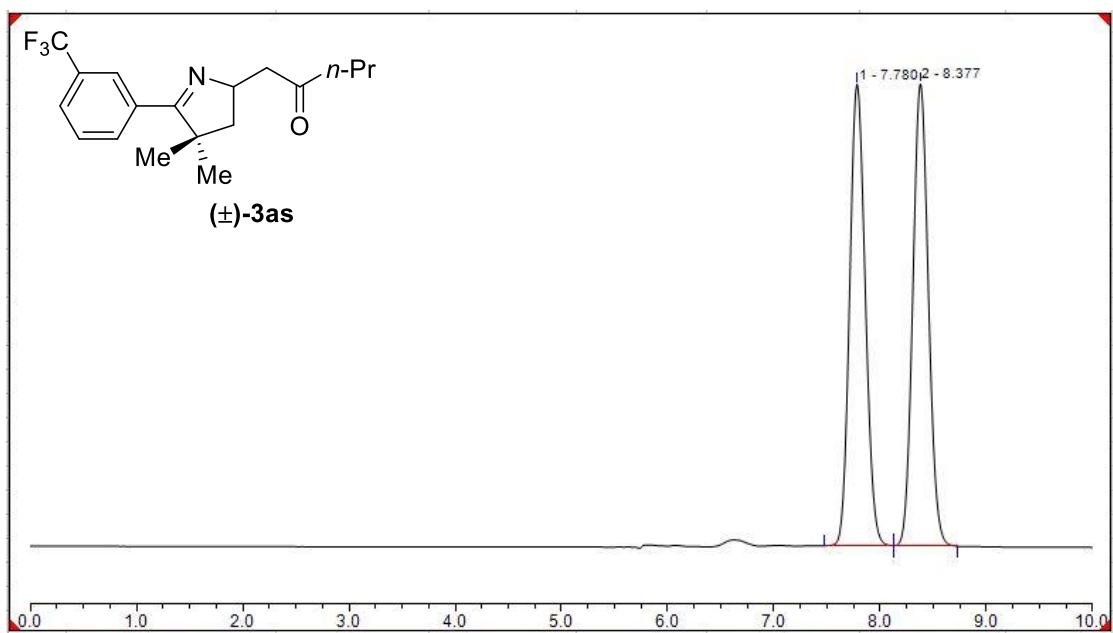
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.810	0.764	5.403	49.95	53.20	n.a.
2		10.013	0.766	4.752	50.05	46.80	n.a.
Total:			1.530	10.154	100.00	100.00	



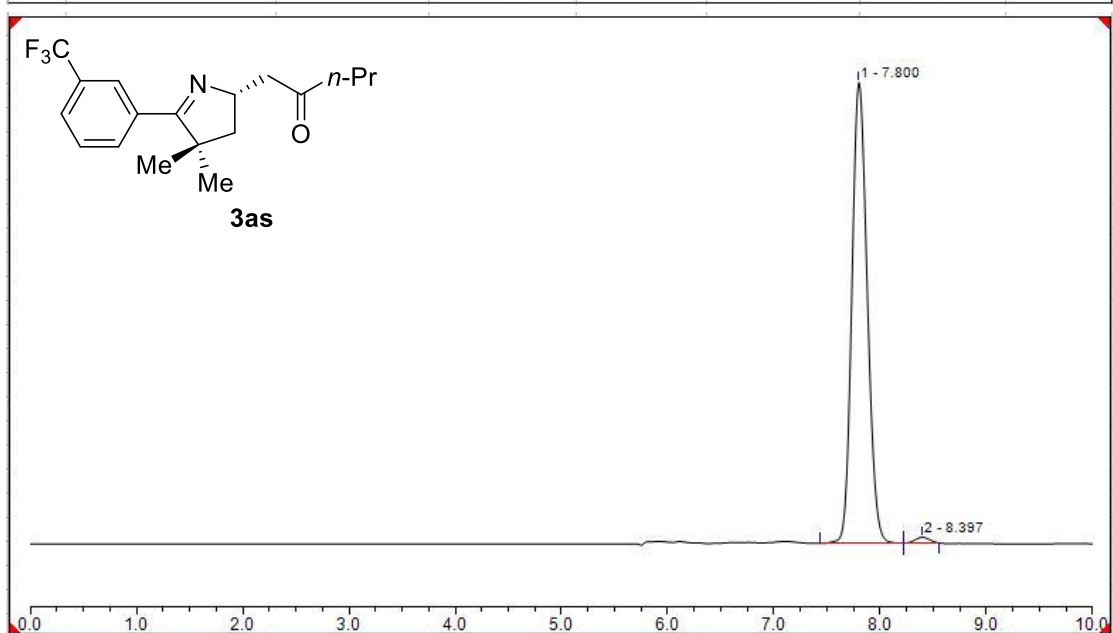
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.820	4.421	30.720	98.15	98.34	n.a.
2		10.033	0.084	0.520	1.85	1.66	n.a.
Total:			4.505	31.240	100.00	100.00	

HPLC (Chiral MD): $t_R = 8.8$ (major), 10.0 (minor)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



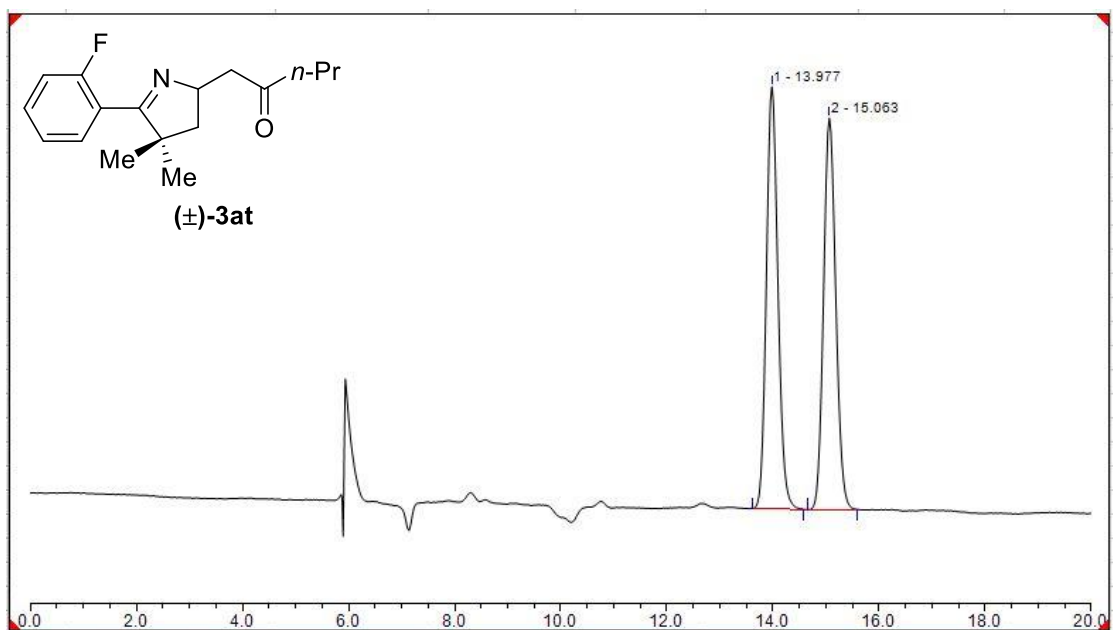
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		7.780	14.801	87.136	49.95	49.96	n.a.
2		8.377	14.830	87.280	50.05	50.04	n.a.
Total:			29.631	174.416	100.00	100.00	



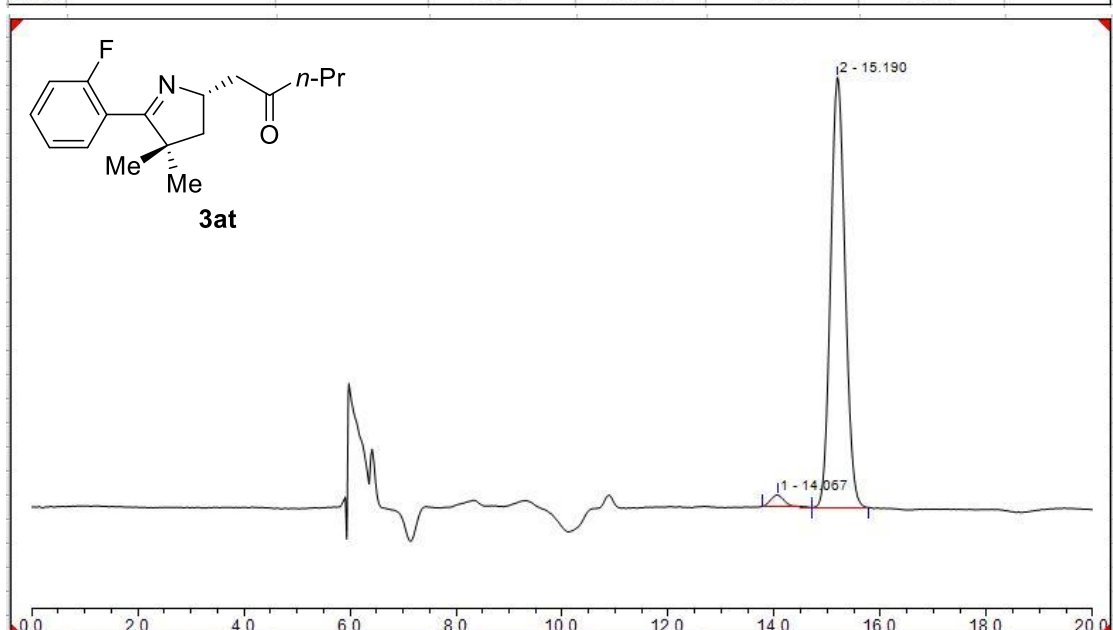
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		7.800	13.229	79.127	98.85	98.76	n.a.
2		8.397	0.154	0.993	1.15	1.24	n.a.
Total:			13.383	80.120	100.00	100.00	

HPLC (Chiral MD): $t_R = 7.8$ (major), 8.4 (minor)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



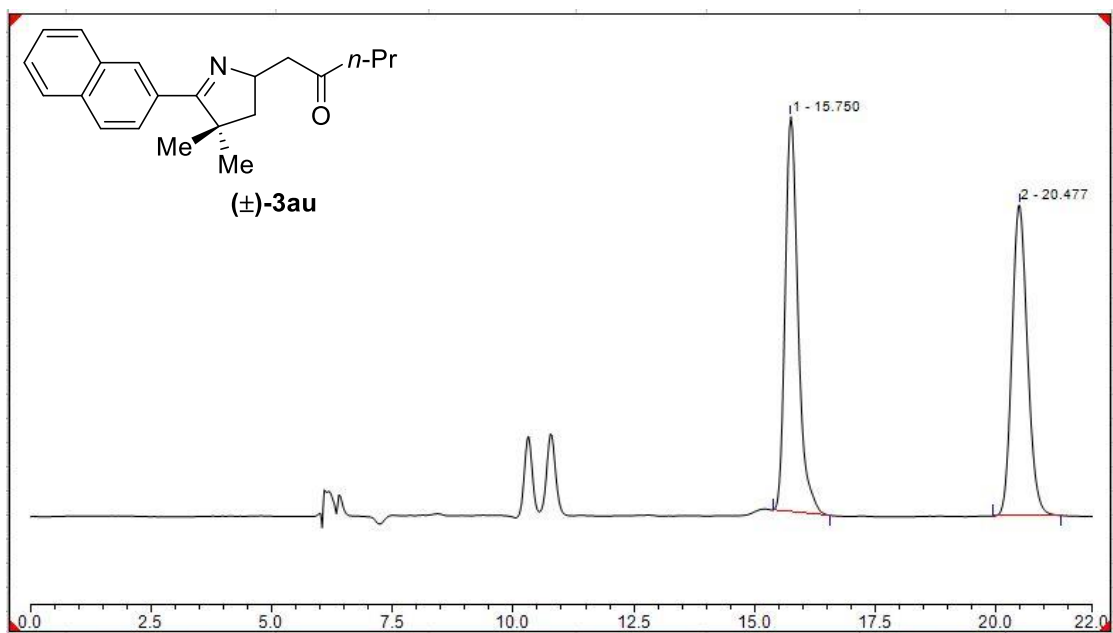
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		13.977	2.009	7.978	50.44	51.87	n.a.
2		15.063	1.974	7.404	49.56	48.13	n.a.
Total:			3.983	15.382	100.00	100.00	



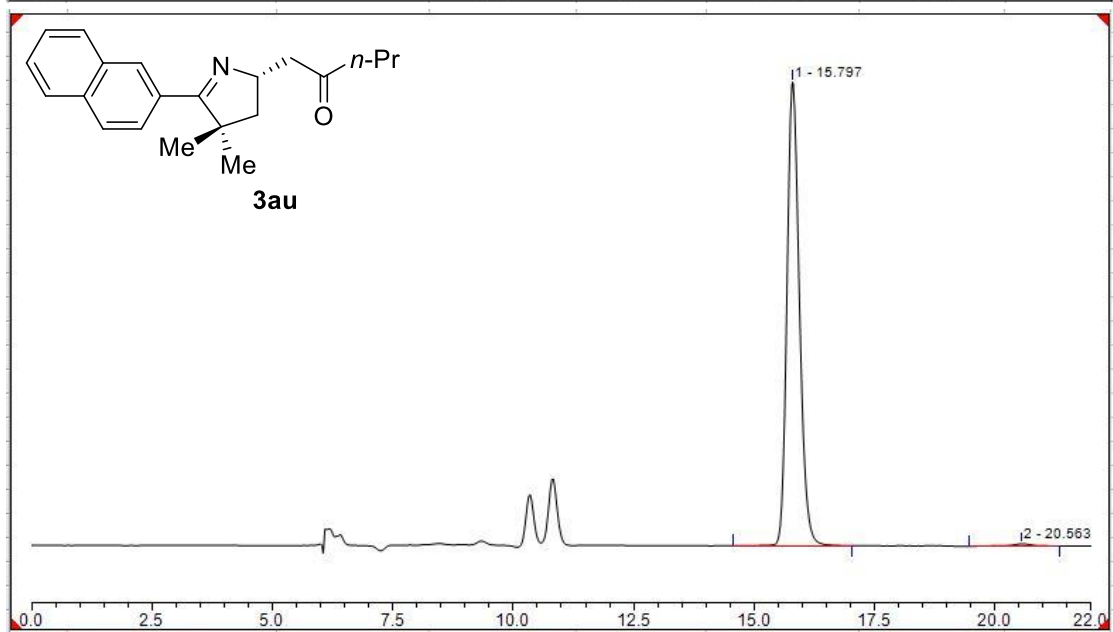
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		14.067	0.075	0.241	2.59	2.65	n.a.
2		15.190	2.801	8.877	97.41	97.35	n.a.
Total:			2.875	9.118	100.00	100.00	

HPLC (Chiral MD): $t_R = 14.1$ (minor), 15.2 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



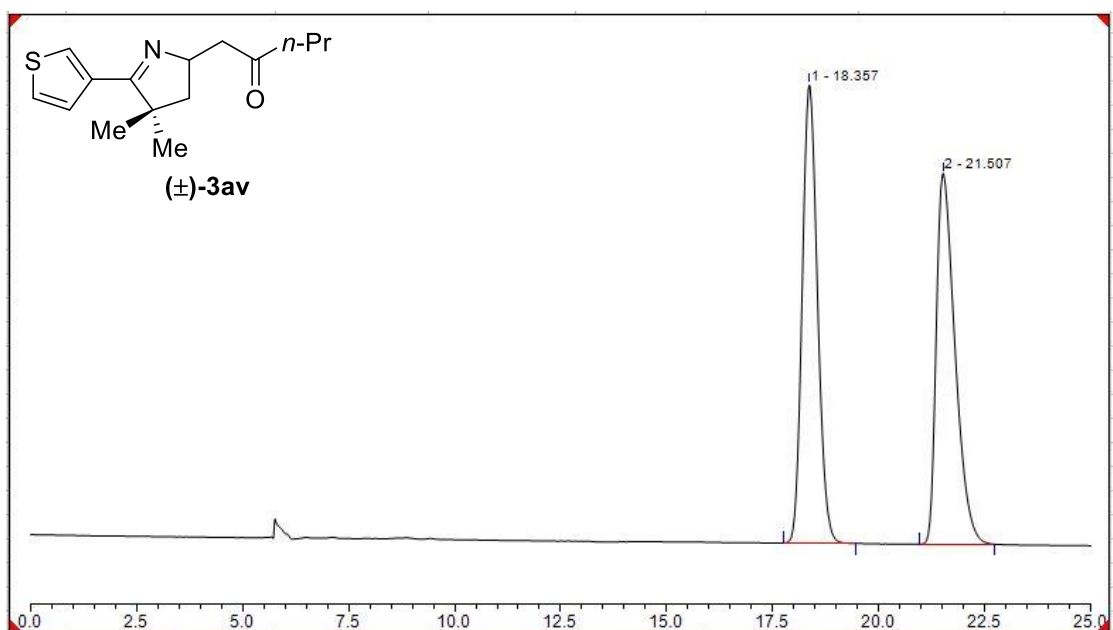
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		15.750	7.346	23.723	51.40	55.97	n.a.
2		20.477	6.945	18.663	48.60	44.03	n.a.
Total:			14.291	42.386	100.00	100.00	



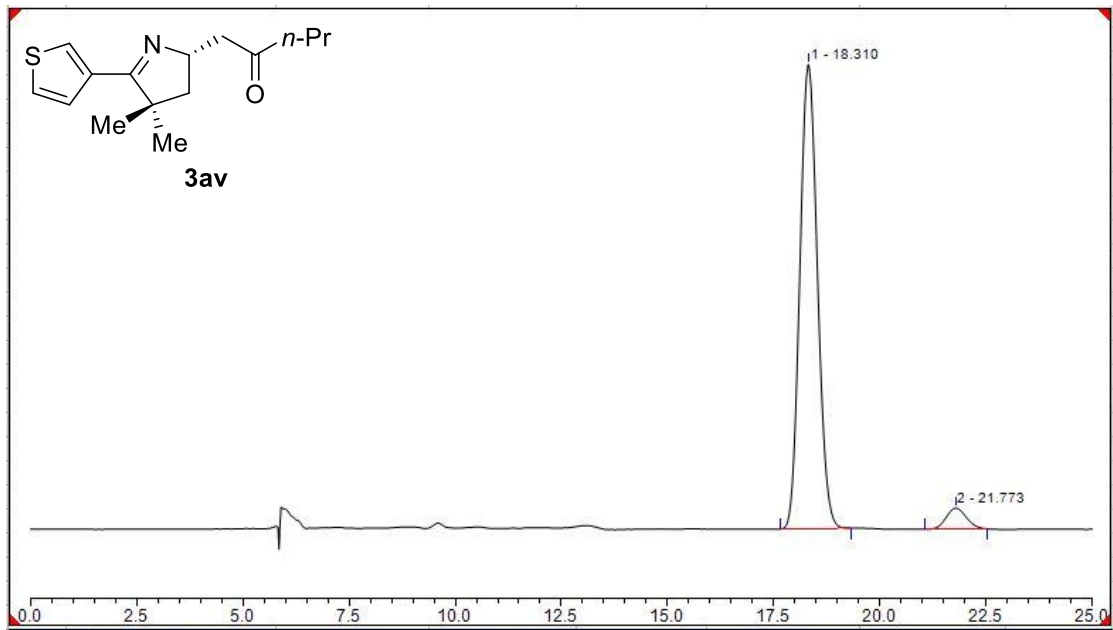
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		15.797	13.142	43.902	99.12	99.51	n.a.
2		20.563	0.116	0.217	0.88	0.49	n.a.
Total:			13.258	44.119	100.00	100.00	

HPLC (Chiral MD): $t_R = 15.8$ (major), 20.6 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



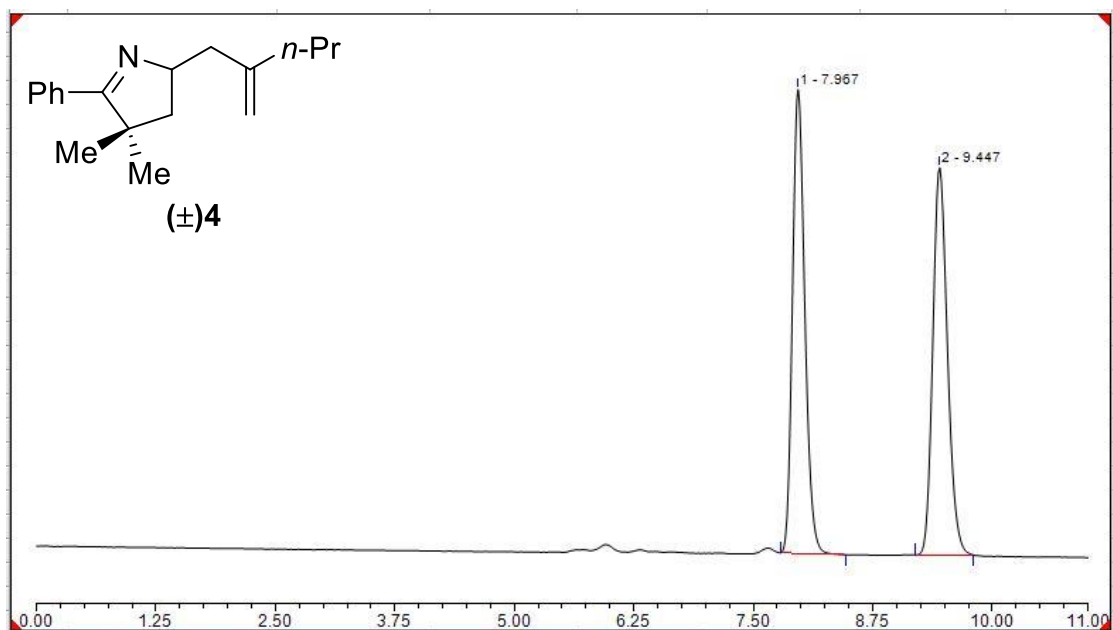
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		18.357	14.734	35.432	50.15	55.25	n.a.
2		21.507	14.647	28.696	49.85	44.75	n.a.
Total:			29.381	64.128	100.00	100.00	



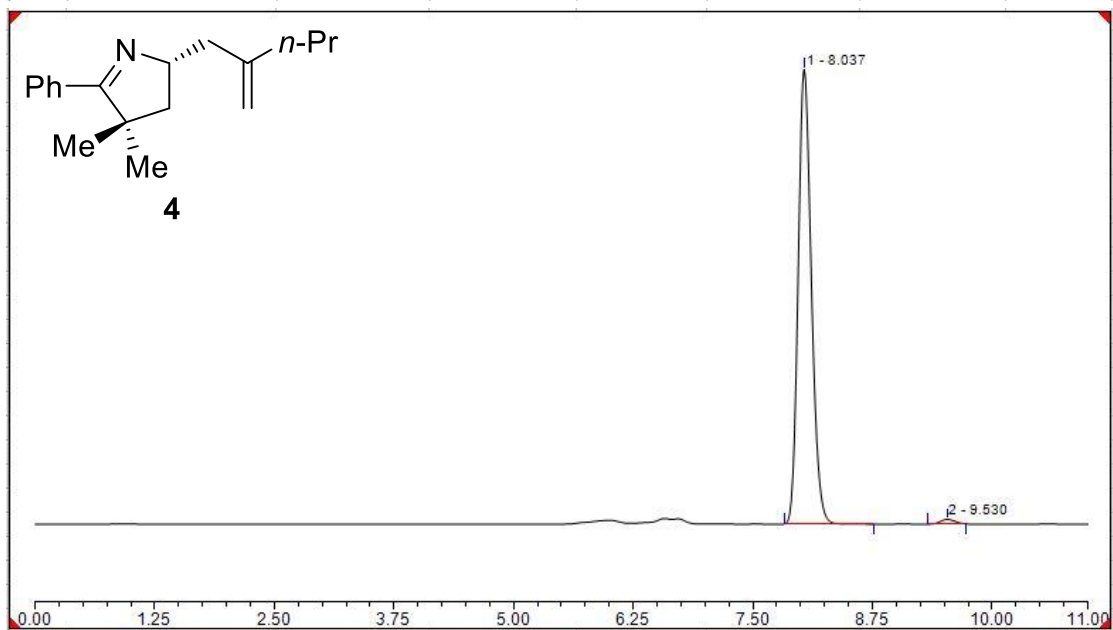
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		18.310	17.141	35.891	95.05	95.69	n.a.
2		21.773	0.892	1.615	4.95	4.31	n.a.
Total:			18.033	37.506	100.00	100.00	

HPLC (Chiralpak AD-H): $t_R = 18.3$ (major), 21.8 (minor)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



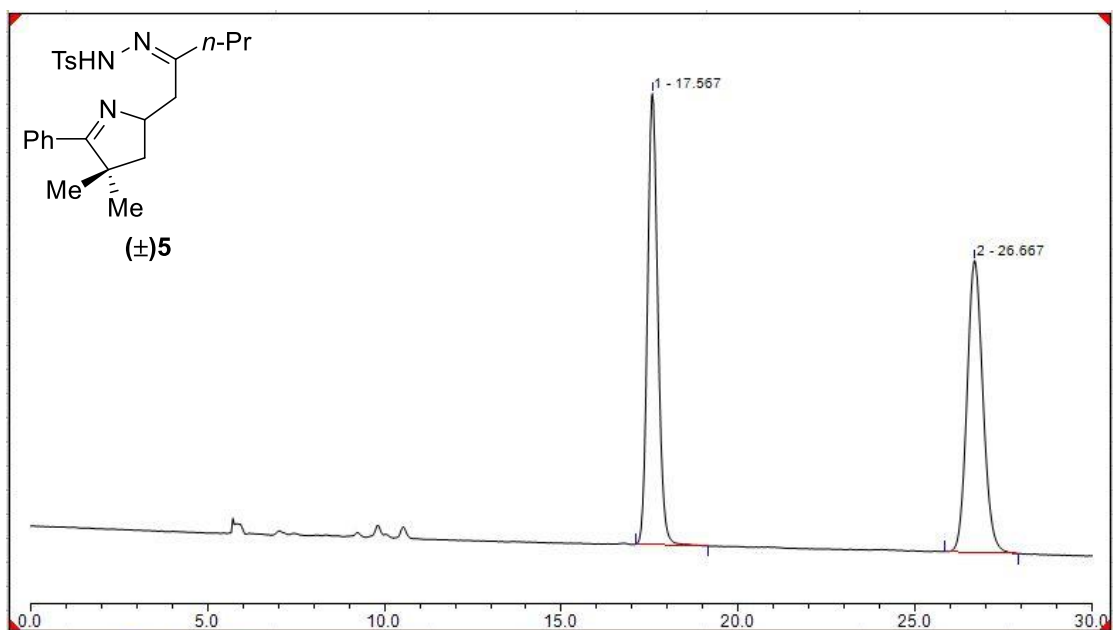
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		7.967	2.610	17.540	50.17	54.48	n.a.
2		9.447	2.593	14.652	49.83	45.52	n.a.
Total:			5.203	32.192	100.00	100.00	



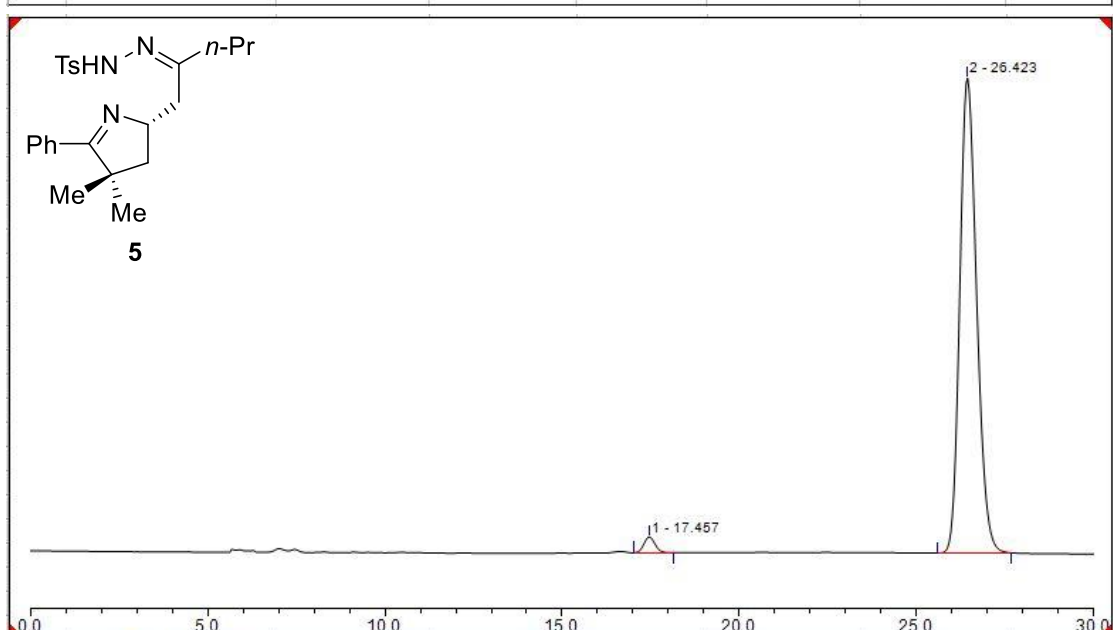
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		8.037	9.962	62.412	98.91	98.99	n.a.
2		9.530	0.110	0.639	1.09	1.01	n.a.
Total:			10.071	63.051	100.00	100.00	

HPLC (Chiralpak AD-H): $t_R = 8.0$ (major), 9.5 (minor)

Condition: 98:2, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



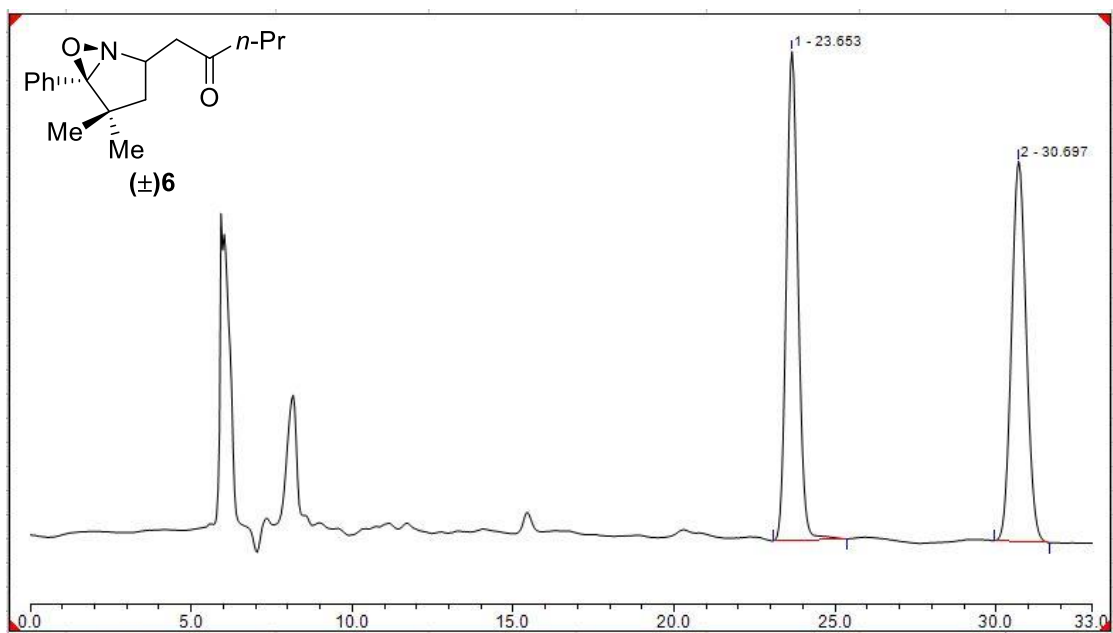
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		17.567	4.176	12.391	49.96	60.71	n.a.
2		26.667	4.183	8.018	50.04	39.29	n.a.
Total:			8.359	20.409	100.00	100.00	



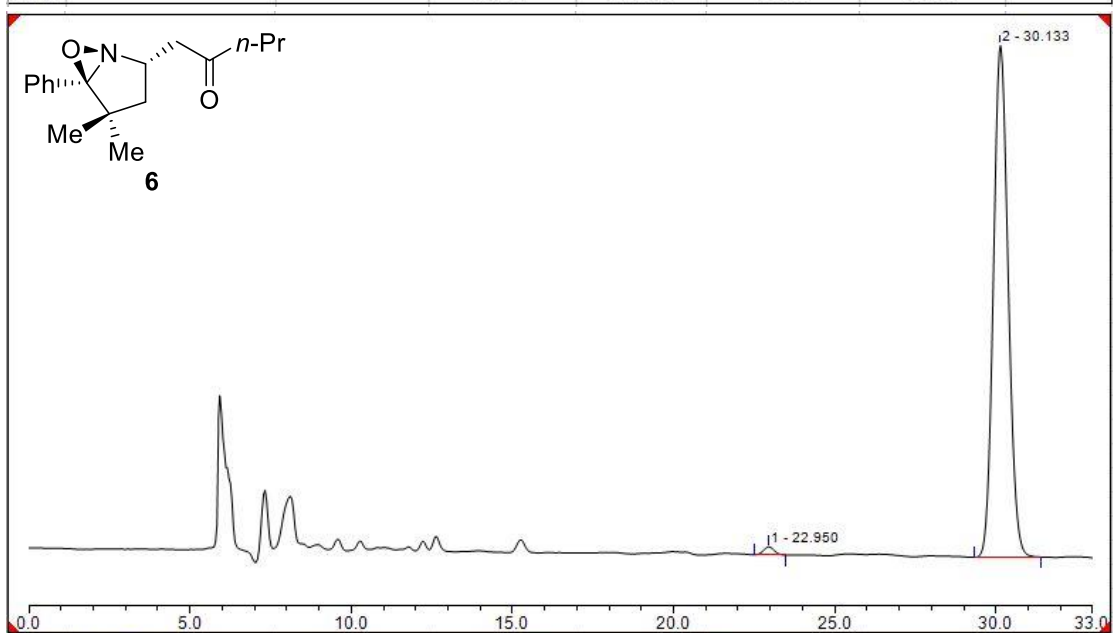
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		17.457	1.086	2.993	2.16	3.23	n.a.
2		26.423	49.294	89.542	97.84	96.77	n.a.
Total:			50.380	92.535	100.00	100.00	

HPLC (Chiral MD): $t_R = 17.5$ (minor), 26.4 (major)

Condition: 90:10, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



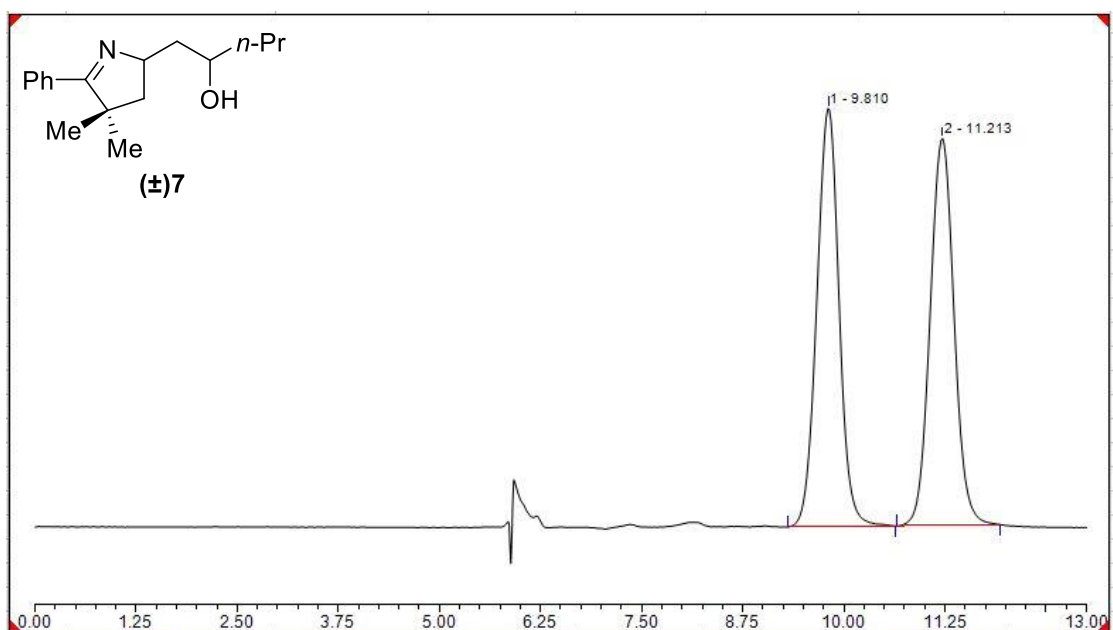
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		23.653	15.903	37.761	50.54	56.26	n.a.
2		30.697	15.562	29.359	49.46	43.74	n.a.
Total:			31.465	67.120	100.00	100.00	



Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		22.950	0.591	1.528	1.14	1.56	n.a.
2		30.133	51.322	96.478	98.86	98.44	n.a.
Total:			51.913	98.006	100.00	100.00	

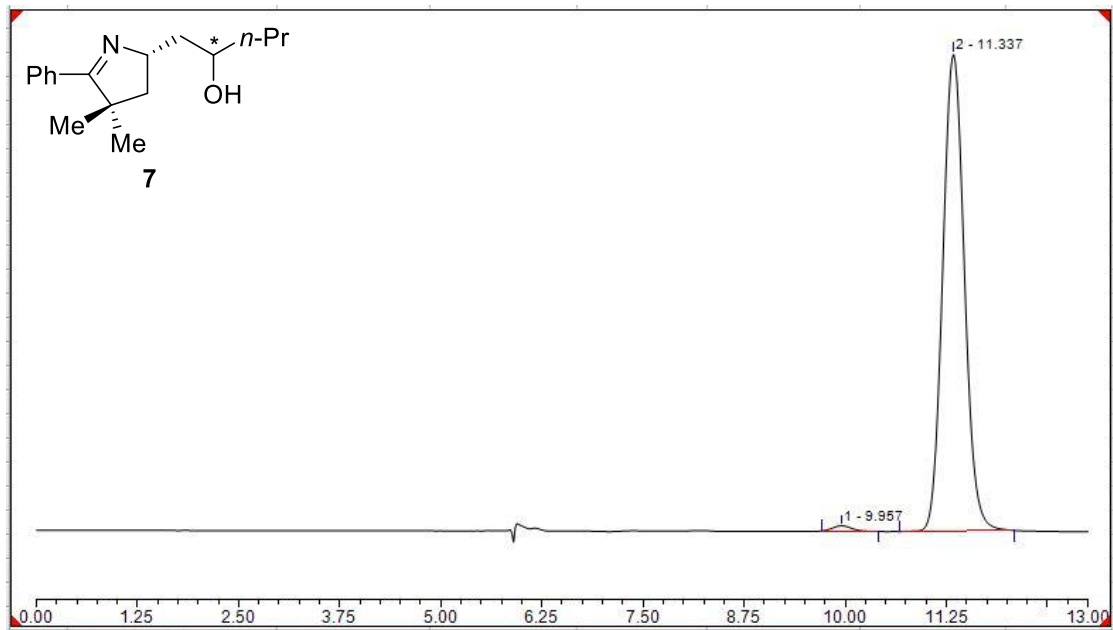
HPLC (Chiral MD): $t_R = 23.0$ (minor), 30.1 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 190 nm.



Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		9.810	3.662	11.509	50.14	51.96	n.a.
2		11.213	3.641	10.639	49.86	48.04	n.a.
Total:			7.304	22.147	100.00	100.00	

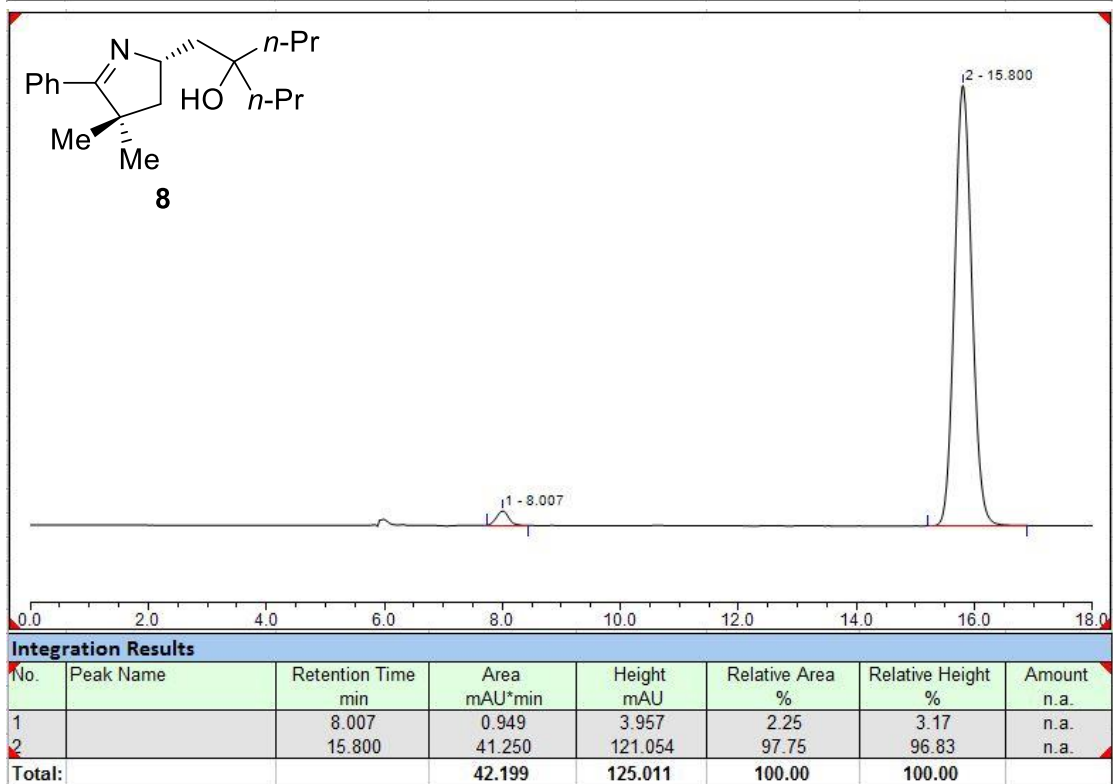
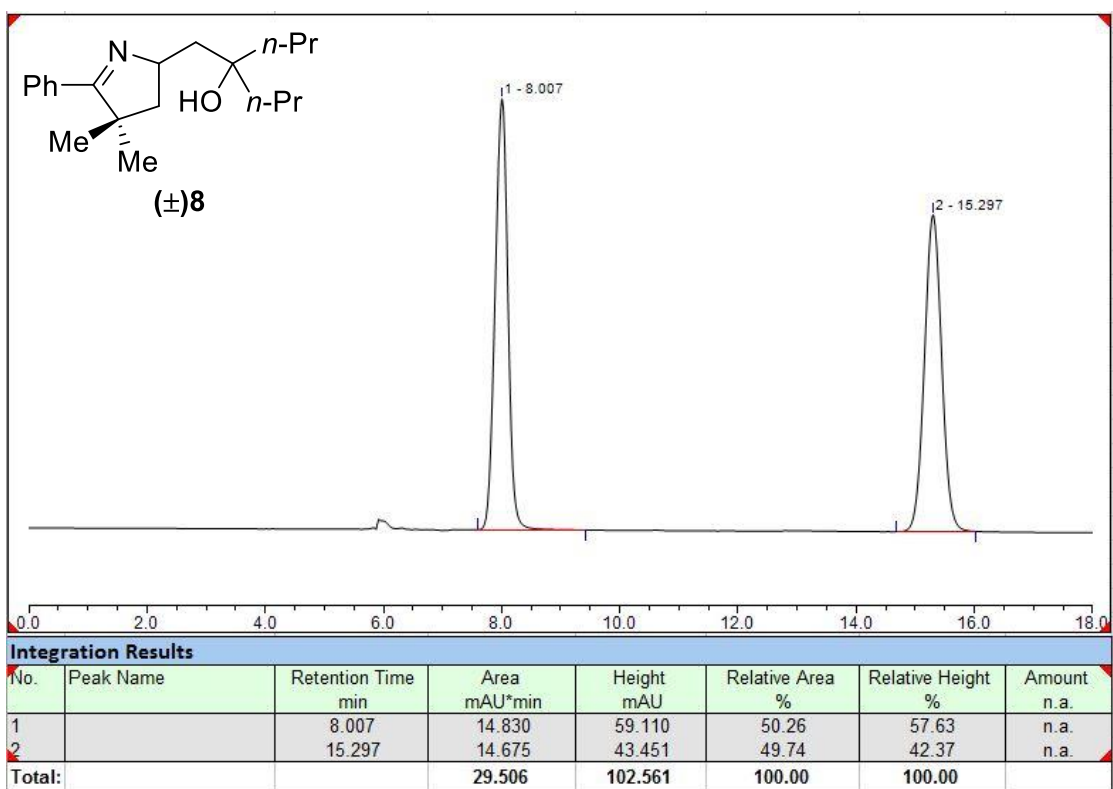


Integration Results

No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		9.957	0.224	0.834	0.97	1.12	n.a.
2		11.337	22.818	73.759	99.03	98.88	n.a.
Total:			23.042	74.593	100.00	100.00	

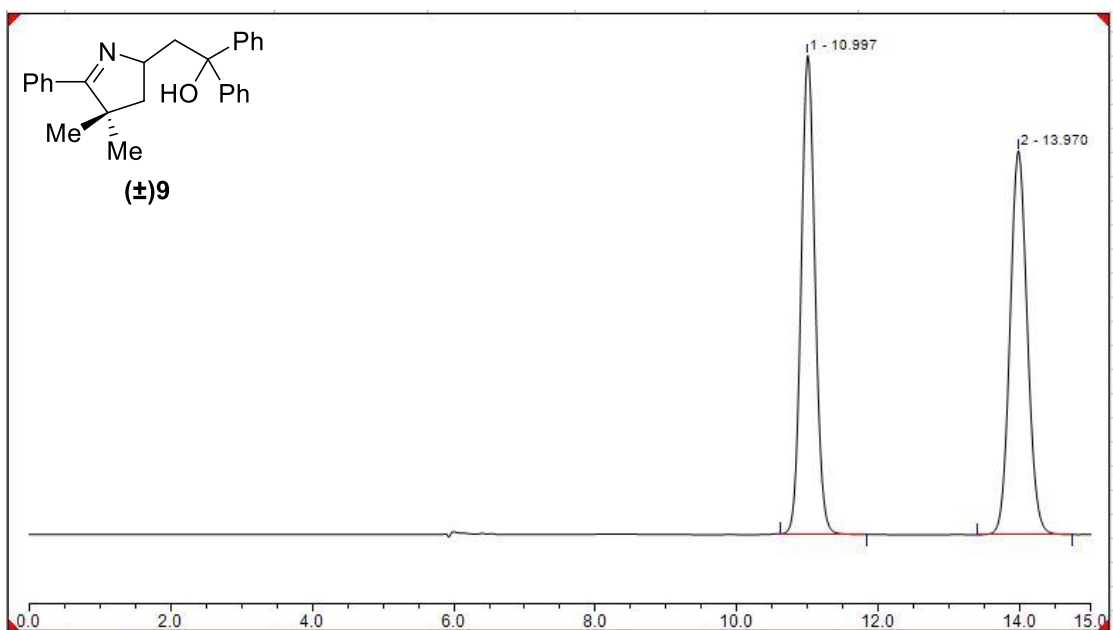
HPLC (Chiral MD): $t_R = 10.0$ (minor), 11.3 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.

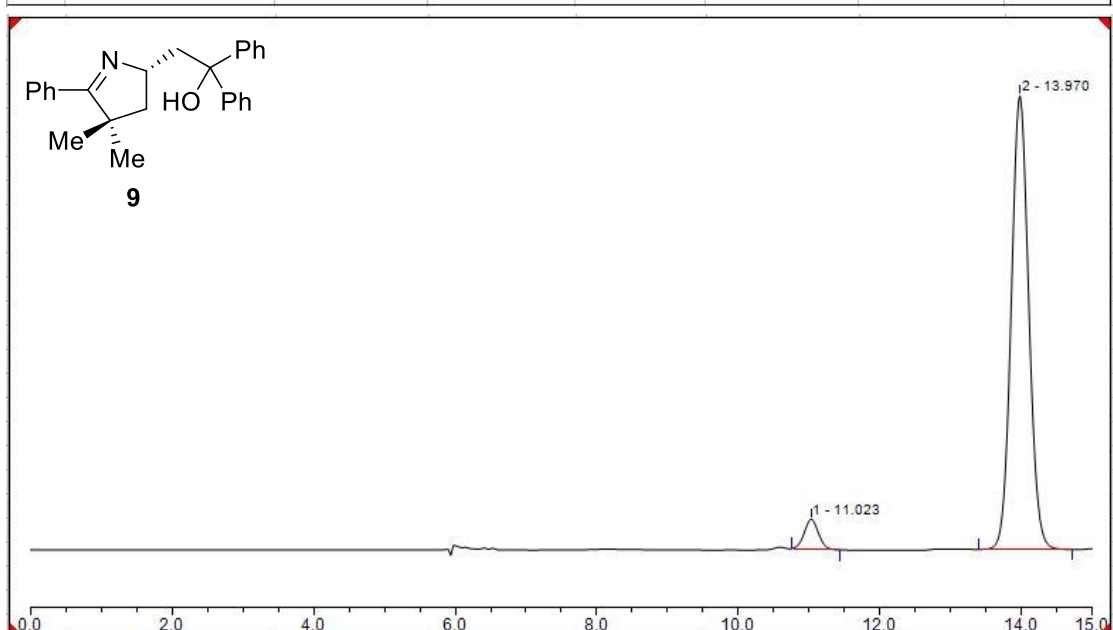


HPLC (Chiral MD): $t_R = 8.0$ (minor), 15.8 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



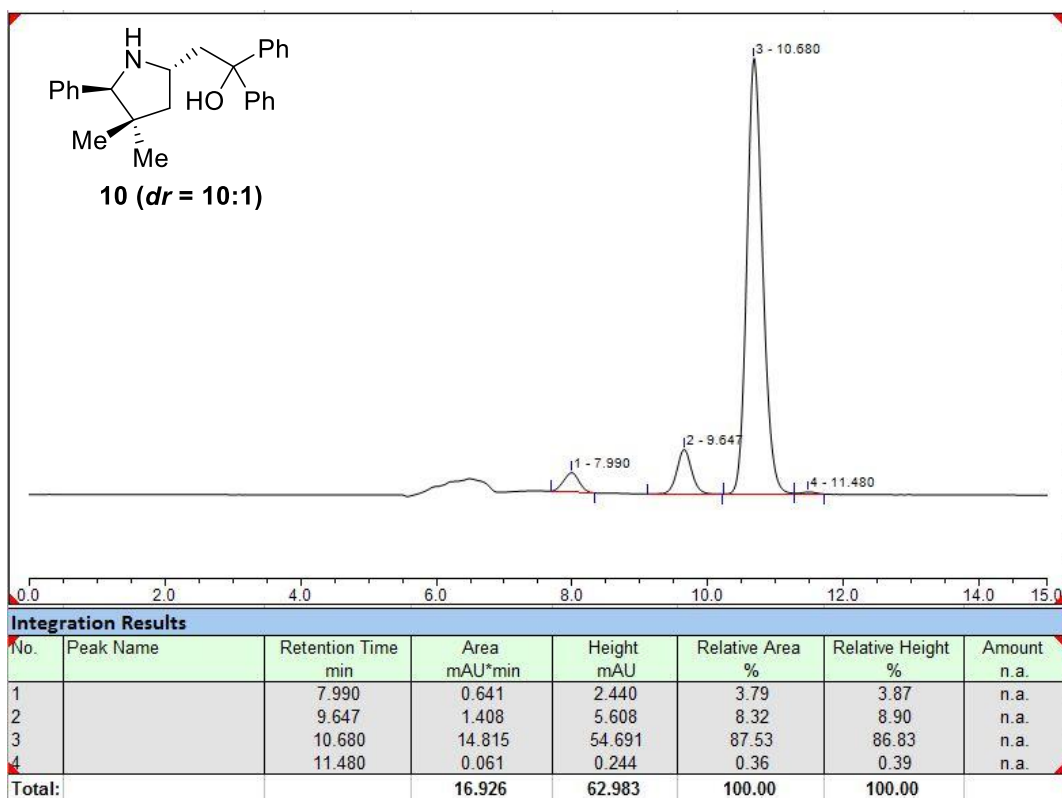
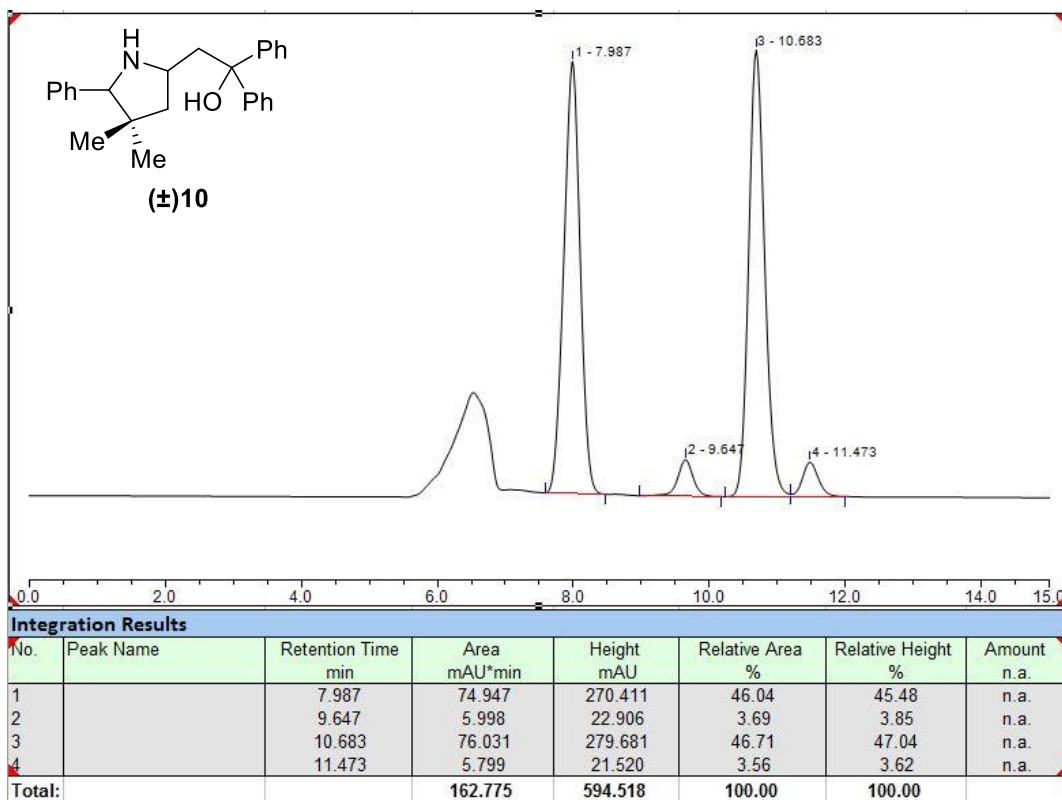
Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		10.997	33.482	147.893	49.99	55.48	n.a.
2		13.970	33.502	118.658	50.01	44.52	n.a.
Total:			66.983	266.551	100.00	100.00	



Integration Results							
No.	Peak Name	Retention Time min	Area mAU*min	Height mAU	Relative Area %	Relative Height %	Amount n.a.
1		11.023	1.306	5.651	5.06	6.18	n.a.
2		13.970	24.515	85.722	94.94	93.82	n.a.
Total:			25.821	91.373	100.00	100.00	

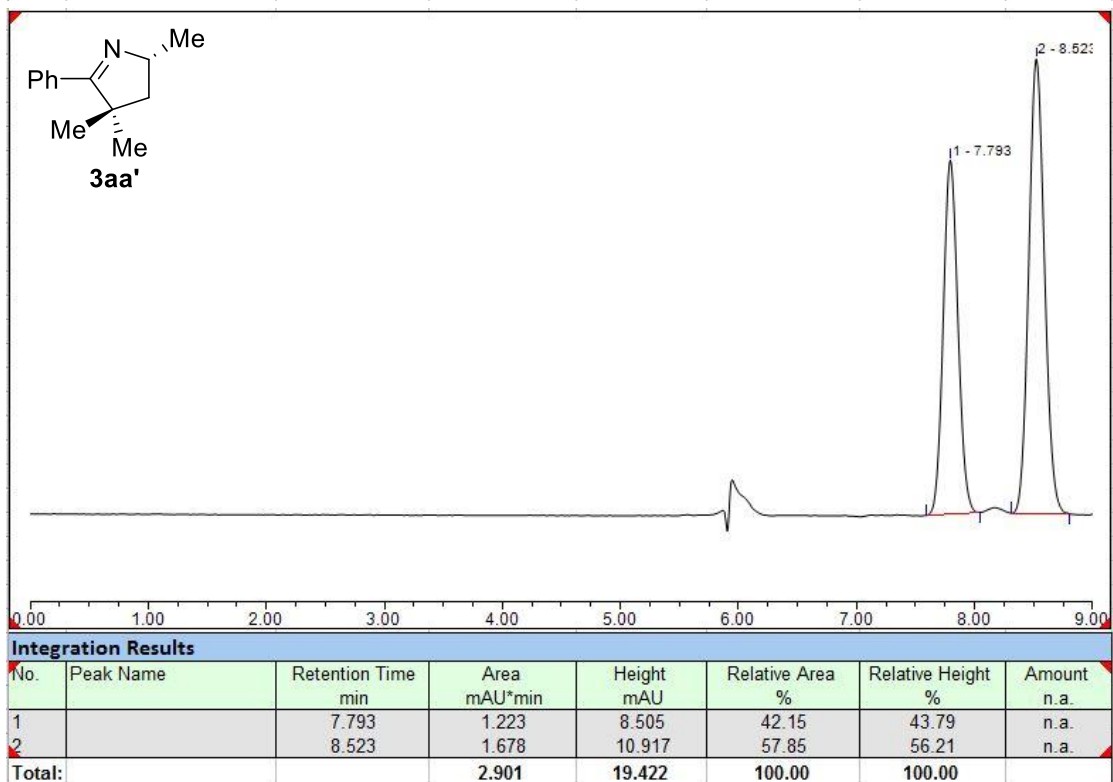
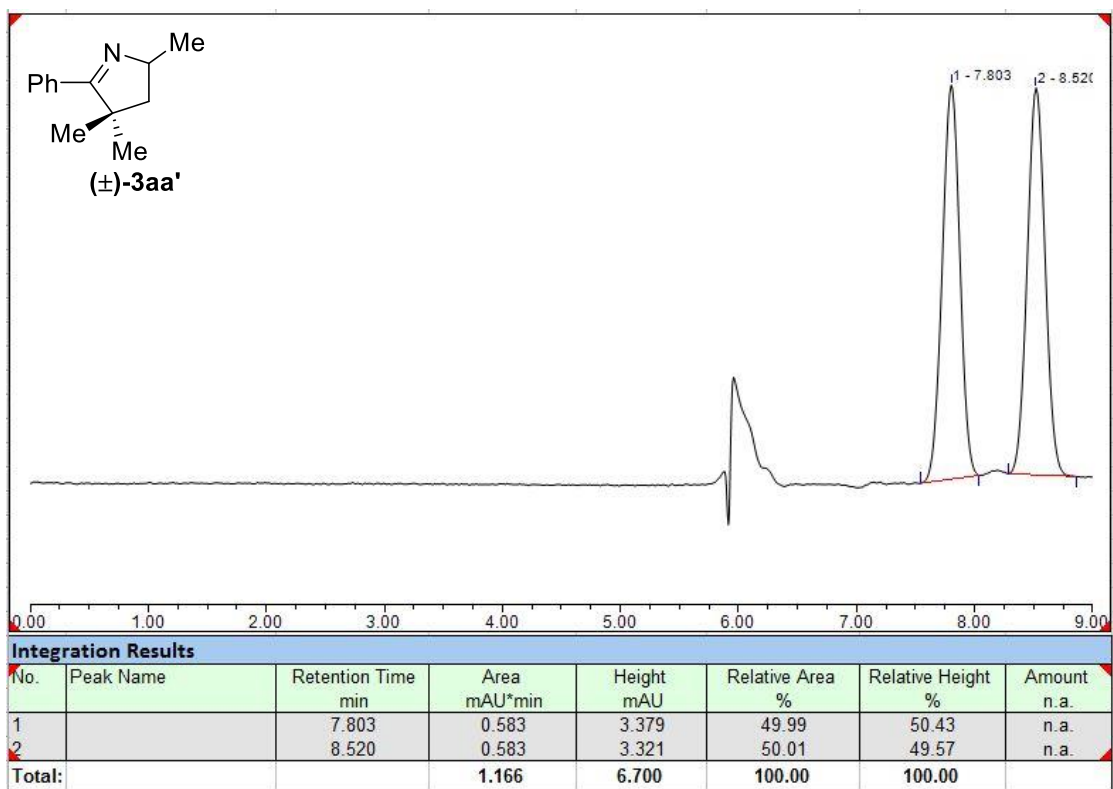
HPLC (Chiral MD): $t_R = 11.0$ (minor), 14.0 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



HPLC (Chiralpak AD-H): t_R = 8.0 (minor, major diastereomer), 9.6 (major, minor diastereomer), 10.7 (major, major diastereomer), 11.5 (minor, minor diastereomer)

Condition: 65:35, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.



HPLC (Chiral MD): $t_R = 7.8$ (minor), 8.5 (major)

Condition: 95:5, *n*-Hexane:*i*-PrOH, flow rate 0.5 mL/min, 25 °C, 254 nm.